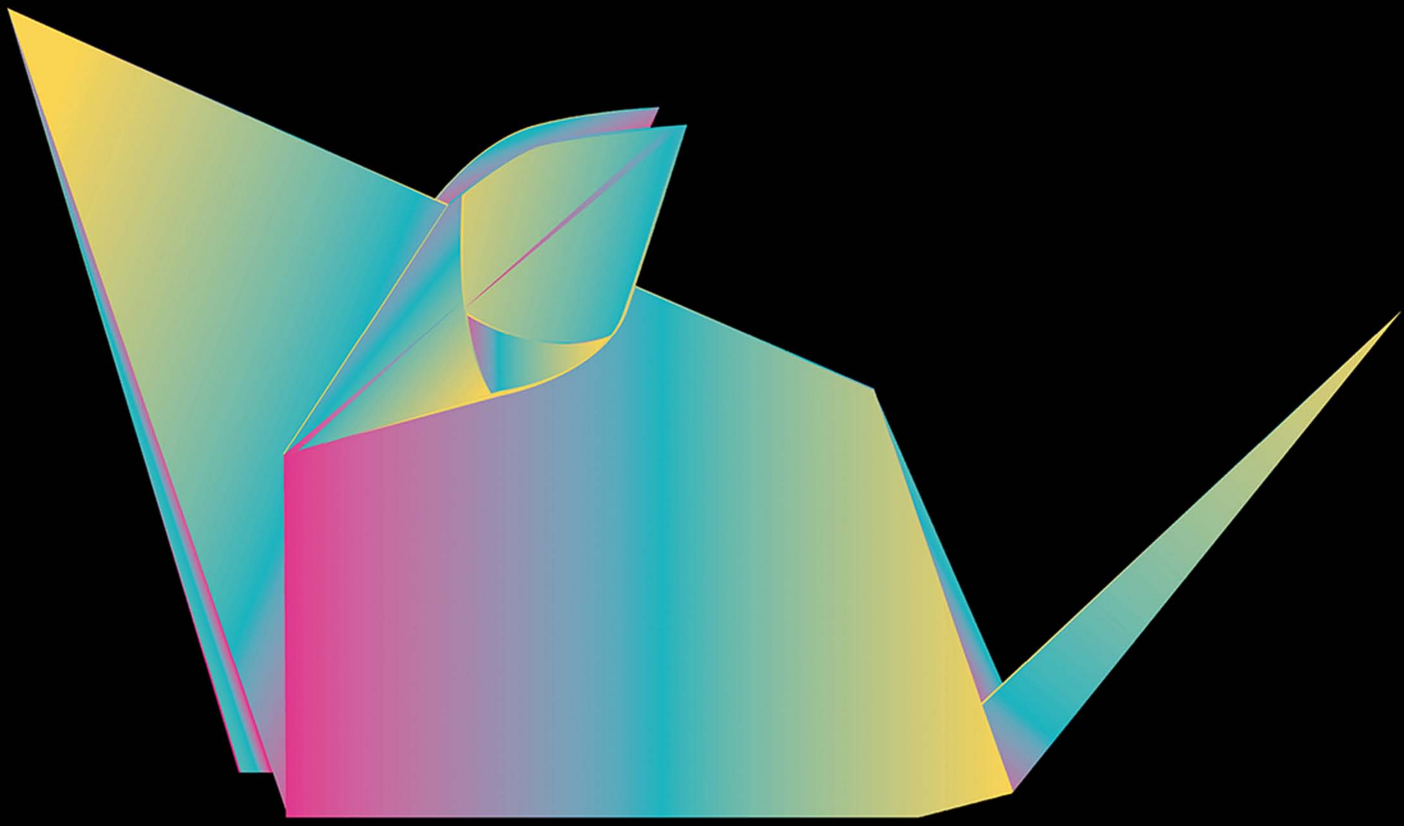
RICHARD W. MALOTT AND KELLY T. KOHLER



PRINCIPLES OF BEHAVIOR

Eighth Edition

SUPPORT MATERIAL

ROUTLEDGE

Principles of Behavior

Known for both its narrative style and scientific rigor, *Principles of Behavior* is the premier introduction to behavior analysis. Through an exploration of experimental, applied, and theoretical concepts, the authors summarize the key conversations in the field. They bring the content to life using humorous and engaging language and show students how the principles of behavior relate to their everyday lives. The text's tried-and-true pedagogy makes the content as clear as possible without oversimplifying the concepts. Each chapter includes study objectives, key terms, and review questions that encourage students to check their understanding before moving on, and incorporated throughout the text are real-world examples and case studies to illustrate key concepts and principles.

This edition features some significant organizational changes: the respondent conditioning chapter is now Chapter 1, a general introduction to operant conditioning is now covered in Chapters 2 and 3, and the introduction to research methods is now covered in Chapter 4. These changes were made to help instructors prepare students for starting a research project at the beginning of the course. Two new chapters include Chapter 5 on the philosophy supporting behavior analysis, and Chapter 24 on verbal behavior that introduces B. F. Skinner's approach and terminology. This edition also features a new full-color design and over 400 color figures, tables, and graphs.

Principles of Behavior is an essential resource for both introductory and intermediate courses in behavior analysis. It is carefully tailored to the length of a standard academic semester and how behavior analysis courses are taught, with each section corresponding to a week's worth of coursework. The text can also function as the first step in a student's journey into becoming a professional behavior analyst at the BA, MA, or PhD/EdD level. Each chapter of the text is integrated with the Behavior Analyst Certification Board (BACB) task list, serving as an excellent primer to many of the BACB tasks.

Richard W. Malott taught and did research in experimental analysis, higher education, autism, and organizational behavior management. He was a co-founder of the Behavior Analysis program at Western Michigan University (WMU) and a co-founder of Association for Behavior Analysis International (ABAI). He has received two Fulbright Senior Scholar Awards, WMU's Distinguished Teaching Award, and ABAI's Award for Public Service in Behavior Analysis.

Kelly T. Kohler earned her PhD at Western Michigan University (WMU) under the mentorship of Dr. Malott. Following graduation, she joined the faculty at WMU. During her time there, she helped oversee the Behavior Analysis Training System (BATS) lab, which specialized in training students to become practitioners with a solid foundation in the science of human behavior. She also helped start the Kalamazoo Autism Center. Her areas of interest include autism and other developmental disabilities, verbal behavior and generative language, teaching behavior analysis, and training practitioners.

Principles of Behavior

Eighth Edition

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Brief Contents

Brief Contents

Detailed Contents

Preface

We designed this book for introductory and intermediate courses in behavior analysis **from the first-year-college to the master's level**. We designed it to be readable, entertaining, engrossing, and highly motivating, as well as intellectually, theoretically, and behavior-analytically rigorous. We designed it to serve as a **general, liberal arts introduction to behavior analysis**, as well as a first step in **becoming a professional behavior analyst at the BA, MA, or PhD/EdD** level. And for the large number of students interested, we've designed this book as an excellent introduction to and a large first step in the training needed to become a **Board Certified Behavior Analyst** and/or a parent or professional who can skillfully help **children with autism**; and we've done so without decreasing the book's value as an introduction to behavior analysis for those interested in heading toward **basic laboratory research** or other areas of **applied behavior analysis**. Furthermore, we wrote the book in a style that's much more readable and accessible and much less pompous than this opening paragraph is. And what's really weird is that we've succeeded in all these semi-conflicting goals, as demonstrated by the large number of students across the generations and across the editions of this book since 1968, students who have gone on to become practitioners, teachers, researchers, presidents of the Association for Behavior Analysis, and authors of competing behavior-analysis texts—students, many of whom would not have been convinced to travel the behavior-analytic path if they had not discovered it in the context of *Principles of Behavior*. Too self-promoting? Naw; just true.

What's New in Our 8th Edition?

As with all our previous editions, we've done considerable continuous quality improvement based on feedback from our students and your students and you, trying to make the writing more and more clear, relevant, and engaging. But the main change has been in the structure of the book: We've moved the respondent conditioning chapter from Chapter 21 to Chapter 1. Chapters 2 and 3 are then a general introduction to operant conditioning, even including a brief mention of rule-governed behavior. And we introduce research methods in Chapter 4 and the philosophy behind behavior analysis in Chapter 5, still working to make the chapters as clear and engaging as possible.

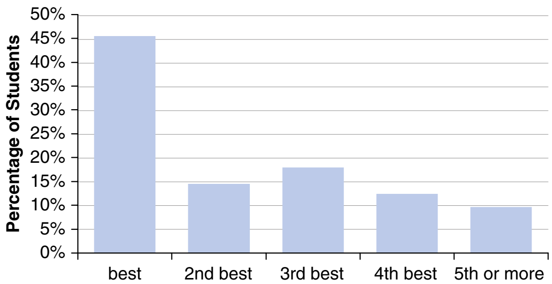
Why did we make this radical change in the structure of our book? 'Cause you asked us to. And a large part of it was that several of you want to get your students started on a research project early in your course. Makes sense, and we hope these changes help.

Also, we added a separate chapter dealing with verbal behavior, introducing Skinner's approach and terminology, in a manner we hope is clear and engaging. And finally, we reduced the emphasis, at least the visual emphasis, on autism, as many instructors don't want their students to get the impression that applied behavior analysis is only about autism. Yet, at the same time, we've still included more than enough to boost along those who wish to take their first step, or giant leap, toward becoming BCBAs or BCaBAs.

Anonymous Student Data From Earlier Editions

Some social validity and performance data for students at Western Michigan University: This figure shows that most of our undergrads rate *Principles of Behavior* (*POB*) as the best textbook they've read while in college. Also most undergrads rate *Principles of Behavior* as very valuable or valuable, compared to other textbooks they've had in college.

Compared to all the other textbooks you've had in college, where would you rank *Principles of Behavior*?



Instructor Notes

This book covers avoidance in Chapter 17, because we deal with issues such as the difference between a warning stimulus and a discriminative stimulus, which is facilitated by reading Chapter 14 on discrimination. However, those wishing to follow the more traditional approach of combining avoidance and escape in the same chapter can easily assign the first seven sections of Chapter 17 along with Chapter 7, and then deal with the more complex issues when the students have progressed through the rest of the book to Chapter 17.

Special Thanks

Thank you to the many reviewers who helped us improve this edition. Without your advice, *Principles of Behavior* would not be where it is today.

A very special thank you to the grad students in WMU's Behavior Analysis Training System's Behavioral Boot Camp over the years for all of their deep thoughts, spell checks, grammar checks, and opinions on the 7th edition and new content for the 8th edition. And especially for their detailed editing—Clare Christie, Sofia Peters, and Emily Goltz. In our case, it takes a whole lab to raise a book; thanks gang.

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Richard W. Malott and Kelly T. Kohler
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Western Michigan University

PART I

Respondent Conditioning

CHAPTER 1

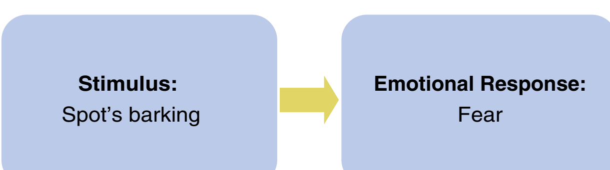
Respondent Conditioning

Behavior Analyst Certification Board 5th Edition Task List Items		
B-3.	Define and provide examples of respondent and operant conditioning.	Throughout

Example
Behavioral Clinical Psychology/Behavioral Counseling

BATMAN[1]

At 3 A.M., Zach awoke to the sound of his 6-year-old son screaming and Spot barking. He ran to Sammy's room. The little boy was crouched by the side of his bed, screaming and crying.



Spot's barking moved closer and closer to Sammy's window. The outside door rattled. Next the bathroom door rattled. Then a shadow fell across the bedroom doorway.

Zach: Sammy, calm down, Son.

Zach (at the doorway): Who's there?

Police sirens whined toward the house. Three police cars screeched to a halt in the driveway, their flashing red lights creating an eerie Halloween effect.

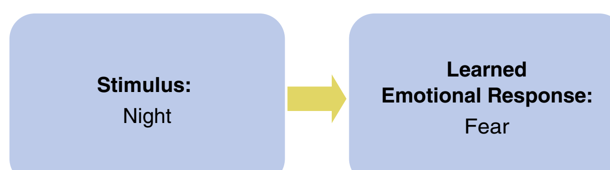
Neighbor (in the driveway shouting): In the house! In the house!

Four police officers ran into the house. And Zach saw the intruder standing at the end of the hallway, paralyzed with their 42″ flat screen in his hands.

Officer: Surrender!

They handcuffed the thief and pushed him into the back seat of the nearest police car.

The danger was over, thanks to their neighbor who'd called the police when the thief had tried to enter his own home. And the episode ended, but not for Sammy. Ever since, Sammy was frightened at night.



Sammy didn't want to go to bed, and when he did, it was only because Zach insisted. He wanted the lights on and asked Zach to sleep in his room with him. The boy would do everything possible to stay awake. Often he played Batman until he got on Zach's nerves. They both ended up being awake a good part of every night.

Zach was a widower and raised Sammy with no extra help, and now he was arriving late to work. And Sammy began to bring home bad grades, though he'd been a top student. So for help, Zach went to Dr. Dawn Baker, a behavioral clinical psychologist. (As we follow her throughout this book, we'll see how she uses the principles of behavior to help people with their psychological problems [i.e., behavioral problems].)

Dawn asked Zach to make a note of each night Sammy was frightened. She also asked him to give Sammy a flashlight. But he could only use it briefly, when he was frightened, and couldn't keep it on all night.

Ten days later, Zach brought Sammy to see Dawn.

During the first interview, she found that 6-year-old Sammy loved Batman.

Dawn: Sammy, close your eyes. Imagine you're watching TV with your dad. And the Batman program has just finished. Your dad tells you it's time for bed, and just then Batman appears and sits down next to you.

Sammy: Yes.

Dawn: Great! Now imagine that Batman tells you he needs you on his missions to catch the bad guys. But he wants you to get your sleep in your bedroom, and he'll call on you when he needs help. Isn't that cool!

Sammy: Yes.

Dawn: Now Dad puts you in your bed and leaves both of the lights on and the three blinds up. Batman is also there. Can you see?

Sammy: Yes, I can see Daddy and Batman in my room and all the lights are on.

Dawn: Well, if you're scared, raise your finger.

Dawn repeated this fantasy, but each time she made it a little more frightening—one blind down, two down, three down; one light off, two off; Zach talking, then leaving the room; Spot barking in the distance, then next to the window; the outside door rattling, then the bathroom door; shadows falling across the window, and then across the room. Well, not really more frightening. It might have been, but she only gradually increased the "threat." And Sammy reacted less fearfully with each repeated exposure. And besides, she made sure Batman was there, just in case.

Sammy lifted his finger if he felt afraid. When he raised his finger, Dawn asked if he could see Batman with him, what he was doing, the color of his clothes and so on.

Dawn used this technique for four sessions. In the first three sessions, she covered increasingly frightening situations. And she reviewed all of those situations in the fourth session.

Zach recorded each day that Sammy was frightened. We call this the *baseline*, the period before we try to change things. So during the 10 days before Dawn started helping Sammy, he was frightened every night. But while working with Dawn, the number of nights Sammy was frightened gradually decreased. Between days 36 and 60, Sammy was frightened only on three nights. After that, they recorded no more problems for the 3 months that Dawn followed up with Sammy. Batman's buddy had become fearless at last.

QUESTION

1. Describe an intervention for eliminating the fear of darkness.

   a. Describe the anxiety-generating situation.
   b. How did Dawn use fantasies to get rid of the fear of darkness?

Concept

PHOBIAS

Sammy's problem is common among children his age; it is often described as a darkness phobia (fear of darkness). Traditionally, we say that the term ***phobia*** refers to a long-lasting, intense, irrational fear.*

This fear is produced by what once were neutral stimuli. Those neutral stimuli have acquired aversive properties because they've been associated with other stimuli that already produce fear.

Young children who develop early illness and require a doctor's attention cry or exhibit other emotional behaviors when the doctor approaches them. For these children, seeing the doctor and experiencing aversive events such as getting a hypodermic injection occur at the same time, so the doctor's presence produces fear responses. It is not surprising that these fear responses often generalize to other individuals, particularly to people wearing white coats or, in some instances, to strangers in general.

We want to emphasize the irrational aspect of the phobia because the situation that the individual reacts to normally could do that person no harm. People with phobias often consult clinical psychologists. The reactions to the fear-provoking situations are real, and we can observe them directly. They often involve avoidance and escape responses. Sometimes the escape or avoidance responses are extreme and in themselves may cause harm to the client or to those around the client. Even if an overt, dramatic escape or avoidance response does not occur, the client may react emotionally, by grimacing, becoming rigid, turning pale, or raising the heart rate or blood pressure, for example.

Often, when the phobic client comes to the therapist's office, the client doesn't know or remember what events resulted in the phobia. Some traditional therapists spend session after session trying to uncover the initiating circumstances. But awareness of the conditions that initiated the phobia doesn't seem to reduce the fearful reaction.

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* But that may be a misleading way to describe the problem because it suggests there is a *thing* called phobia and there is a *thing* called fear. *Phobia* has no special, fundamental, psychological importance; it just means that the person who uses the word thinks it's irrational for someone to find that stimulus aversive because it will not be paired with other aversive stimuli in the future.

QUESTION

1. *Phobia*—give an example.
   Note: When we ask for examples, we will normally be happy with examples from the text. We won't mean original examples, unless we say so. But your instructor might want original examples; better check.

IVAN PAVLOV*

And finally we get to Pavlov. (Note: In 1904, Russian physiologist Dr. Ivan Pavlov received the Nobel Prize for his work on the physiology of digestion, not for his ringing the bell, which is what you and I know him for.) So Pavlov was already a world-famous physiologist when he discovered respondent conditioning in 1901 (before even your great grandfather was born). In doing his physiological research on glands and the endocrine system, he surgically implanted tubes into dogs' glands to measure their secretion. So he had to keep the dogs restrained in a harness for a long time. This meant his assistant, Ivan Filippovitch Tolochino, had to feed the dogs while they were restrained. Usually when Ivan F. presented food to these dogs, they would salivate and drool. You might observe this in your own pet doggy, Fang, at feeding time.

Stimulus: Food → **Response:** Salvation

But after some time, Pavlov and Ivan F. noticed a strange thing: The dogs would salivate whenever Ivan F. entered the room, even with no food in hand. They salivated, as if Ivan F. himself were the lunch he'd brought.

Stimulus: Ivan F. → **Learned Response:** Salvation

This led Pavlov down the experimental trail to discover respondent conditioning: He placed a dog in restraint as before. He gave the dog meat powder, which immediately produced salivation. But now along with the meat powder, he also rang a bell. Of course, the meat powder paired with the bell always produced salivation. But then he rang the bell without the meat powder. And the mere sound of the bell produced salivation just as sight of Ivan F., the research assistant, had.

Stimulus: Bell → **Learned Response:** Salvation

Salivating when the bell rang resulted from the previous pairings of the taste of the meat powder and the sound of the bell. Pavlov had discovered what we call **respondent conditioning**. The response of salivation to the bell was conditional on (dependent on) the bell's previous pairing with the food—a conditioned response.

Unconditioned Stimulus: Food → **Unconditioned (Unlearned) Response:** Salvation

Conditioned Stimulus: Bell → **Conditioned (Learned) Response:** Salvation

We tie it all together and we get Pavlov's respondent conditioning.

Before Conditioning

Unconditioned Stimulus: Food → **Unconditioned Response:** Salvation

Conditioning (Pairing) Procedure

Stimulus to be Conditioned: Bell → **Unconditioned Stimulus:** Food → **Unconditioned Response:** Salvation

After Conditioning

Conditioned Stimulus: Bell → **Conditioned Response:** Salvation

This historical experiment influenced the development of psychology for decades. And even today, psychologists are still doing research based on Pavlov's ideas.

* This section will be a review for many of you, as there is a good chance you've learned about Pavlov in your other classes. However, most students report that they found it helpful to review it again.

QUESTIONS

1. Who was Ivan Pavlov?
2. What was the great discovery of Ivan Pavlov and Ivan Filippovitch Tolochino? (Don't worry, you won't have to remember the name "Ivan Filippovitch Tolochino" for the quiz; but do make sure "Pavlov" rings a bell.)
3. Diagram Pavlov's respondent conditioning with his dog.

Concept

RESPONDENT CONDITIONING

We have terms to describe Pavlov's procedure:

The sound of the bell is a **conditioned stimulus (CS)**. It will only elicit (cause) salivation if it's been paired with food. Its ability to elicit salivation is conditional (dependent) on its food pairing.

So the salivation to the bell is a **conditioned response (CR)**, because it's elicited (caused) by the conditioned stimulus.

And, of course, the food itself is an **unconditioned stimulus (US)**. Its ability to elicit salivation is not conditional (dependent) on previous pairing.

So, obviously, the salivation to the food is an **unconditioned response (UR)**, because it's elicited by the unconditioned stimulus.

And then we get Pavlovian conditioning or **respondent conditioning**.

The sound of the bell, **conditioned stimulus (CS),** is paired with the food, **unconditioned stimulus (US)**, and it elicits salivation, the **conditioned response (CR)**.

In other words, here we use the term **conditioning** to describe the procedure of pairing the conditioned stimulus with the unconditioned stimulus.* (Note that Pavlov wasn't doing anything illegal so he didn't "illicit" the response, he "elicited" it, by ringing the bell. And if it helps, you can also think of "elicit" as meaning "produce" as well as "cause.")

Oh yes, **Pavlovian conditioning** is so famous that it's also called **respondent conditioning** and sometimes even called **classical conditioning**.

* Note that, in the diagrams for the conditioning procedure, there's a dashed arrow, rather than a solid one between the stimulus to be conditioned and the following stimulus. It's dashed to indicate that the stimulus to be conditioned precedes but does not cause or produce the following stimulus.

Definition: CONCEPTS AND PRINCIPLES

Unconditioned stimulus (US)

- A stimulus that elicits (causes) a response
- without previous pairing with another stimulus.

Unconditioned response (UR)

- A response elicited (caused) by
- an unconditioned stimulus.

Conditioned stimulus (CS)

- A stimulus that elicits (causes) a response
- because of previous pairing with another stimulus.

Conditioned response (CR)

- A response elicited (caused) by
- a conditioned stimulus.

Respondent conditioning

- Pairing a neutral stimulus
- with an unconditioned stimulus
- causes it to elicit the conditioned response.

Example Experimental Analysis: PAVLOV'S DOG

Unconditioned stimulus (US)

- Food

Unconditioned response (UR)

- Salivation

Conditioned stimulus (CS)

- Bell

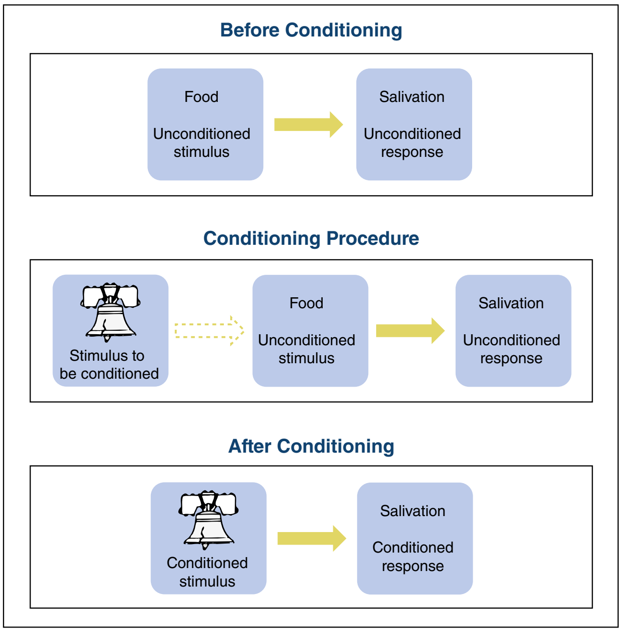
Conditioned response (CR)

- Salivation

Respondent conditioning

- Pairing the bell
- with the food
- causes the bell to elicit salivation.

And, at the risk of being too repetitious, let's take glance at another diagram of Pavlov's original respondent-conditioning procedure:



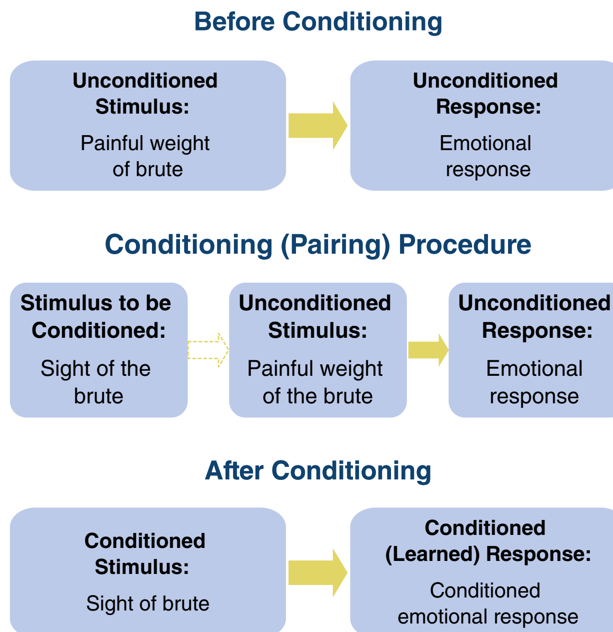
QUESTION

1. Define and give examples of the following concepts:
    a. *unconditioned stimulus*
    b. *unconditioned response*
    c. *conditioned stimulus*
    d. *conditioned response*
    e. *respondent conditioning*

Fear and Football

Saturday morning, Big State U's alumni day and an alumni football game, with Gentleman Juke out of retirement to play quarterback. First quarter. The crowd roars, or at least Mae, Dawn, and Sid roar, as Juke sees the monster linebacker rushing toward him. Splat, he's on his back, crushed by the burly brute; he feels the pain, his stomach churns, his heart races, his adrenaline flows. He pushes the brute off himself with mighty force, barely restraining his fist from going for the guy's face mask, and settles for a loud oath.

Second quarter. Juke sees the monster linebacker rushing toward him. His stomach churns, his heart races, his adrenaline flows (in other words, he's very emotional). He dodges to the right, back, to the right again, and then rushes forward, across the goal line, almost as agile and fast as when he used to be part of the BSU 11. And his emotional responses give him the energy to save his butt. They're much the same emotional response that the pain of the brute's weight caused. In other words, the fearful emotional response can also become a conditioned response elicited by a conditioned stimulus (previously paired with painful stimuli).



Tying It All Together

The respondent conditioning process caused the sound of Pavlov's bell to elicit his dog's conditioned salivation, because it had been paired with food (the unconditioned stimulus). It caused darkness to elicit Sammy's conditioned fear response, because it had been paired with loud noises and flashing lights. And it caused the sight of the rushing monster linebacker to elicit Juke's conditioned emotional response (which we'll call anger). We're all Pavlov's doggies under the skin.

By the way, most psychologists think we acquire emotional responses through respondent or Pavlovian conditioning. The consistent pairing of emotion-producing stimuli with neutral stimuli may bring about the conditioned fear responses to these other stimuli. Sometimes a single pairing can establish an event or object as a conditioned aversive stimulus, as with Sammy's fear of darkness.

Can you think of any conditioned fear responses that you've learned? Any with just one pairing?

I've got a couple: I'm stopped at the light on Drake Road and KL Avenue. A guy on prescription drugs crashes into the back of my old Volvo, permanently trashing it; and for a while after that, I get a little antsy every time I have to stop at that light.

Before Conditioning

Unconditioned Stimulus: Crash → **Unconditioned Response:** Fear

Conditioning (Pairing) Procedure

Stimulus to be Conditioned: Light on Drake & KL → **Unconditioned Stimulus:** Crash → **Unconditioned Response:** Fear

After Conditioning

Conditioned Stimulus: Light on Drake & KL → **Conditioned (Learned) Response:** Fear

By the way, this happened to me again, in my new Volvo at the light on Parkview Avenue and Stadium Drive. This time the woman sped away as soon as I got out of my car to check the minor damage on my rear bumper. And for just a few days after that, when I pulled up to that stoplight I'd get a very light antsy feeling, even though I hadn't even been thinking about the collision until I felt the feeling.

What about conditioned happiness responses? It's dinner time on Saturday night, my door chimes ring, and I get a little happy, because that's the conditioned stimulus for my happiness at the sight of Motoko, which will occur in a couple of seconds.

Before Conditioning

Unconditioned Stimulus: Motoko → **Unconditioned Response:** Happiness

Conditioning (Pairing) Procedure

Stimulus to be Conditioned: Door chimes → **Unconditioned Stimulus:** Motoko → **Unconditioned Response:** Happiness

After Conditioning

Conditioned Stimulus: Door chimes → **Conditioned (Learned) Response:** Happiness

And one more little conditioned happiness response: When I walk into the West Hills Fitness Center every morning, I find myself starting to smile. Why, because I'm going to work out? No way! Because I'll be seeing a few friends, mainly just nodding acquaintances, with whom I can exchange a friendly hello. Yeah that humble little interact-with-people stimulus can cause a conditioned smiling response when I see the conditioned stimulus—entering into the gym.

QUESTION

1. Give an example of *respondent conditioning* of an emotional response.

Example

CONDITIONING A PHOBIA WITH LITTLE ALBERT[2]

This may be the most notorious experiment in the field of psychology. Also, the most famous. In 1920, John B. Watson and his grad student assistant, Rosalie Rayner, conditioned a phobic reaction in a 9-month-old infant. The infant, Little Albert, was a happy, robust baby; the son of a wet nurse on the campus pediatric hospital staff.

Like Sammy, loud noises startled and frightened him and could cause him to cry.

But he showed no fear of a white rat and other furry animals. So Watson and Rayner did their respondent conditioning experiment by showing him a white rat and then striking a resonant piece of metal with a hammer. It worked: Watson and Rayner conditioned a phobia in Little Albert, complete with his startle response and crying.

Before Conditioning

Unconditioned Stimulus: Loud noise → **Unconditioned Response:** Fear

Conditioning Procedure

Stimulus to be Conditioned: White rat → **Unconditioned Stimulus:** Loud noise → **Unconditioned Response:** Fear

After Conditioning

Conditioned Stimulus: White rat → **Conditioned Response:** Fear

Ethical research? Probably not. In fact, there's no way you'd be allowed to repeat Watson and Rayner's experiment in any university today. Now all research has to meet pretty high ethical standards. Things have changed a lot in the last 100 years, often for the better.

Watson and Rayner thought they had established a phobia that would last for Albert's lifetime if they didn't try to get rid of it. They might have gradually changed Albert's experiences with furry objects until they were always pleasant. In this way, they might have eliminated the phobia they had experimentally established. Unfortunately, they never had the chance to finish this phase of the experiment because Albert's mother removed him from the hospital after they started the last series of experimental procedures.

Let's review: Striking the iron bar behind Albert produced a fear response. This type of response to loud noises is common in all infants and perhaps is reflexive, unlearned behavior. Thus, because the sound from striking the metal bar unconditionally produced an unlearned fear response, we'll call that sound the unconditioned stimulus. We could also define the fear responses that resulted when Watson and Rayner struck the metal bar as the unconditioned response because they were a natural reaction to the noise; the white rat functioned as the conditioned stimulus as Watson and Rayner repeatedly paired it with the unconditioned stimulus, the loud noise. After several pairings, the white rat alone produced the fear response. The fear response to the white rat is the conditioned response. This procedure is the same as the one Pavlov used in conditioning the salivation response.

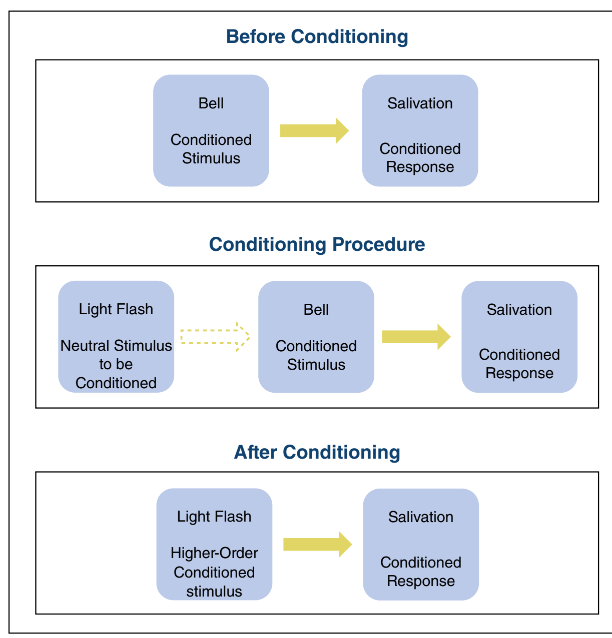
QUESTION

1. Give an example of conditioning a phobia. Include the
   - unconditioned stimulus (US)
   - unconditioned response (UR)
   - conditioned stimulus (CS)
   - conditioned response (CR)
   - conditioning procedure.

HIGHER-ORDER RESPONDENT CONDITIONING

In respondent conditioning, we can create a **higher-order conditioned stimulus,** by pairing a neutral stimulus with a conditioned stimulus, rather than pairing it directly with an unconditioned stimulus. For example, first we might create a conditioned stimulus, by pairing the sound of the bell with some food (bell ==> food). Then we might create a higher-order conditioned stimulus, by pairing a light flash with the bell, not directly with the food (light ==> bell). In turn, we could try to create an even higher-order conditioned stimulus, by pairing the light with the sound of a buzzer, and on and on. And, of course, the further removed the higher-order conditioned stimulus is from the unconditioned stimulus, the weaker it will be until it has no eliciting power. The procedure for creating a higher-order conditioned stimulus is called ***higher-order conditioning.***

True confessions: I shouldn't have implied that Motoko was an **unconditioned stimulus** that the sound of the Saturday-night door chimes were paired with. Her sight was also a **conditioned stimulus** that itself had been paired with many stimuli, both conditioned and otherwise. So my happiness response produced by the door chimes was really a higher, higher, higher-order respondent conditioning process. And, oh yeah, the little social interactions with the guys and gals at the gym are also really conditioned stimuli, not unconditioned ones. But higher-order respondent conditioning rocks!



Definition: CONCEPT

Higher-order respondent conditioning

- Establishing a conditioned stimulus
- by pairing a neutral stimulus
- with an already established conditioned stimulus.

QUESTION

1. *Higher-order respondent conditioning*
   a. Define it.
   b. Give an example.

RESPONDENT EXTINCTION

I'm sure you'll be relieved to know that after I had to stop a few times at the light on Drake and KL, I no longer felt antsy. Why? Because that guy was no longer crashing into the back of my Volvo. And we call that **respondent extinction**.

Respondent Extinction Procedure

Conditioned Stimulus: Light on Drake & KL	X	**Unconditioned Stimulus:** Crash

In other words, the extinction procedure involved presenting the stimulus that had become conditioned stimulus (the light on Drake and KL) but no longer pairing it with the unconditioned stimulus (the crash). So the light on Drake and KL stopped eliciting the conditioned response (fear).

After Extinction

Conditioned Stimulus: Light on Drake & KL	X	**Conditioned Response:** Fear

In respondent conditioning, we extinguish a previously conditioned stimulus by presenting it but no longer following it with the unconditioned stimulus. Back in early Russia, Pavlov rings the bell but no longer presents the food, and gradually Fang stops salivating to the sound of the bell. In other words, the conditioned stimulus extinguishes, as does the conditioned response of salivating to that bell:

Respondent Extinction Procedure

Conditioned Stimulus: Bell	X	**Unconditioned Stimulus:** Food

After Extinction

Conditioned Stimulus: Bell	X	**Unconditioned Response:** Salivation

Same with Sammy's phobia.

Respondent Extinction Procedure

Conditioned Stimulus: Darkness	X	**Unconditioned Stimulus:** Loud noise

After Extinction

Conditioned Stimulus: Darkness	X	**Unconditioned Response:** Fear

Definition: CONCEPT

Respondent extinction

- Present the conditioned stimulus
- without pairing it
- with the unconditioned stimulus,
- or with an already established conditioned stimulus,
- and the conditioned stimulus will lose its eliciting power.

QUESTION

1. *Respondent extinction*
   a. Define it.
   b. Give an example.
   c. Cool; now give another example.

Example

PHIL'S PHOBIA[3]

"You'll like the zoo," Mr. Jones told his 10-year-old son, Phil. "We can see elephants and monkeys, too. We'll have a great time, so let's have no nonsense, OK?"

"OK," Phil said.

All the while Phil was getting dressed to go to the zoo, he was strangely quiet. Phil's mother asked him if he felt well. Phil said he did, but later, just as they were ready to go to the car, he disappeared into the bathroom. The rest of the family waited in the car for him. Fifteen minutes passed.

"This is ridiculous," Jones said.

Five minutes later Jones got out of the car and said, "I'll straighten that kid out!"

When Mr. Jones entered the house, Phil was standing outside the door of the bathroom. As the father approached him, the boy lowered his head and looked sheepish.

"I've had enough," the father said as he grabbed Phil's hand. He half pulled Phil toward the car. When they were within about 30 feet, Phil ceased moving his feet and legs. Mr. Jones dragged the child into the car and slammed the door.

"Now, Phil, I . . ." Mr. Jones stopped short. Phil had turned white. Beads of perspiration ran down his cheeks, and his eyes looked funny and glazed. Just then he let out a wail of anguish that the neighbors could hear a block away. His small body shook and trembled.

He took Phil back to the house and then returned to the car where the rest of the family waited.

"Well, we'll go to the zoo another time," he said. They all got out of the car and walked slowly back to the house.

Two years earlier, Phil had been in a car accident. Ever since, he had been afraid of cars. His fear was real and caused him and his parents constant distress. When Dr. Lazarus met Phil, it took him only a few minutes to diagnose his problem as a car phobia, a type of phobia that occasionally occurs among children. Lazarus knew that Phil had learned his fear of cars, so he could also get rid of it.

During the first session, Lazarus talked to Phil and got to know him. He found that Phil was fond of chocolate. During the next session, he began to treat Phil's phobia. While talking with him, Lazarus would steer the conversation onto the subject of trains, airplanes, buses, and other vehicles. Discussing motor vehicles seems a long way from actually riding in one, but even the confrontations with this stimulus initially elicited mild fear responses in Phil. But Lazarus was sensitive to Phil's reactions and monitored them closely. Whenever Phil showed fear, he didn't comfort the child or try to talk him out of his fear. But as soon as Phil volunteered a positive comment about the subject, he would offer a piece of his favorite chocolate. By the third session, Phil was talking freely and at great length about all types of moving vehicles. He showed no signs of fear. Lazarus thought Phil was ready for the next phase of his treatment.

"Let's play a game today," Lazarus said. He pulled an object out of his pocket. It was a toy car. Immediately Phil stepped back a few steps and looked at Lazarus as if questioning his friendship. Before he said anything else, Lazarus pulled out a candy bar and placed it on the desk. Then he took another car and proceeded to play a game in which he sent the two toy cars crashing into one another head-on. Phil turned white and perspiration formed on his forehead. But Lazarus didn't seem to notice Phil or his fearful state; he remained engrossed in his play, time and time again acting out versions of accidents between the toy cars. Soon Phil began to recover some of his color and moved slightly toward Lazarus. At this point, Lazarus lost momentary interest in his absorbing game, handed Phil a piece of the chocolate bar, and talked to the child. Then he turned back to his game.

As Phil moved closer to Lazarus and the accident-prone cars, he got more and more of his favorite chocolate and more and more of Lazarus's attention. After each accident game in which Phil evidenced no fear, he got a chocolate. Soon Phil was touching the toy cars with no apparent fear. Later Lazarus and Phil spent hours playing the accident game with the toy cars. The game was interspersed with chocolate breaks, and Phil greatly enjoyed himself.

Eventually, Lazarus and Phil played games outside. Lazarus parked a car nearby. They spent hours sitting in it, discussing the accident in which Phil had been involved. As long as Phil entered into this conversation freely and showed no fear, he got pieces of chocolate and lots of attention from his friend. After a while, the two began to take short imaginary rides. One day Lazarus searched through his pockets pretending to look for a piece of chocolate. "We're all out of candy, Phil. Sorry," he said. "Let's go get some more." While telling this to Phil he turned on the ignition and started the car, watching Phil closely as he did. There were no signs of fear. The store was only a block away, but he was in no hurry to get there. Once they did reach the store, they bought a good supply of chocolate, got back into the car, and began to drive around town. They laughed and acted like tourists. Phil chewed his chocolate and watched the sights as he discovered the pleasures of travel.

When they returned to Phil's house, Mr. Jones was waiting in the drive. Phil jumped out of the car, ran to his father, and began to talk about his wonderful trip. Then he left Lazarus and his father alone and went inside to tell his adventures to his mother.
"I guess we're due to go on an outing," Phil's father said.

"Sounds like a good idea. I hear the zoo is good to visit this time of the year," Lazarus smiled.

You might wonder why such phobias last so long. Why don't they extinguish? The problem is that the phobic person avoids the phobic situation. So the phobia never has a chance to extinguish. For Phil to lose his phobia more naturally, he would have to take many trips in the car; but he avoided that. So, without behavioral intervention, a person might maintain an irrational phobia forever.

QUESTION

1. Describe a procedure to get rid of a car phobia.

Concept

SYSTEMATIC DESENSITIZATION

Systematic desensitization is a widely used treatment for phobias, first developed by Wolpe in 1958.[4] It is assumed that anxiety must **not** occur for successful elimination of phobic behavior. In systematic desensitization, we train the client to relax completely. Then we present stimuli in a hierarchy from the least to the most fear-producing ones. The client must be completely relaxed so that the fear is inhibited at each step in the hierarchy.*

Definition: CONCEPT

Systematic desensitization

- Combining relaxation with
- a hierarchy of fear-producing stimuli,
- arranged from the least to the most frightening.

Systematic desensitization could be done *in vivo* or in imagination. With ***in vivo desensitization***, the client uses relaxation skills to face real-life, fear-producing situations. But systematic desensitization can be done in the therapist's office without bringing the client's behavior into direct contact with the real fear-eliciting environment. Instead of actually experiencing stimulus situations closer to those that produce the phobic reaction, the client merely imagines such situations while relaxing in the office.

The therapist using systematic desensitization prefers semi-hypnotic relaxation induced through instructions. Once the client is deeply relaxed, the therapist asks her or him to imagine various environmental situations or stimuli that normally produce a mild phobic reaction. If the client can imagine these situations and yet remain relaxed, the therapist asks the client to imagine another situation that more closely approaches the one the client claims elicits severe phobic responses. Eventually, the therapist asks the client to imagine the situation that seems to elicit the greatest fear responses. The client will be rid of the phobia if he or she can imagine this situation and still remain deeply relaxed.

After completing the procedure, the client should be capable of leaving the therapist's office and facing real situations without experiencing phobic reactions. As unlikely as it seems, clients often can do this. Case reports of systematic desensitization indicate that therapists can use this procedure to treat many phobic behaviors successfully. This technique, along with other behavioral techniques, has made phobic responses a relatively simple problem for the therapist to deal with.

QUESTION

1. Systematic desensitization
   a. Define it.
   b. Give an example.

Behavioral Clinical Psychology A Single-Subject Study

JAZMYN'S STORY[5]

September 2014, Jazmyn, college sophomore at Western Michigan University, first day of class for Psych 1400, Intro to Behavior Analysis. Large lecture hall with 150 students. Way too much for Jazmyn; she ran from the classroom crying, her three-pound Pomeranian comfort doggie, Sox, securely hidden in her backpack. (Jazmyn hadn't left home without Sox for the last five years.)

But Jazmyn stuck with Psych 1400, got sucked in by the 7th edition of *PoB*, the textbook you're reading now, and decided she wanted to become a professional behavior analyst so she could help kids with autism. But she had to get her own act much more together, if she was even going to get in the door.

* More recent research suggests that relaxation is not as crucial as was initially thought. The key component is exposure. The client needs to experience the stimulus without anything bad happening afterwards, which breaks the pairing. In fact, some research seems to indicate that relaxation can actually impede the unpairing process by allowing the client to avoid fully experiencing the fear-producing stimuli.

June 2015, Jazmyn started systematic desensitization with clinical psych doc student, Brianna, at WMU's Psych Clinic. They used emotive imagery where she would imagine smells, temperature, lighting, and noises that were conditioned stimuli eliciting fear responses. When the emotive imagery would get a little too much, she would do muscular relaxation exercises, in order to decrease her conditioned emotional response. Before starting her behavior therapy, before extinction of her conditioned fear stimuli, she had to leave classes several times a week. By mid-fall 2016, she'd had to leave class zero times a week. Extinction of fearful stimuli works.

And how's it going now? "So far, so good, though there are still times when I recognize that I'm uncomfortable, but I no longer need to leave class."

Do you still do relaxation exercises?

"Yes, regularly. I practice checking out the environment and deep breathing when I notice that I'm becoming a little fearful."

What about extinguishing the conditioned fear stimulus of being away from home without her little Sox? Jazmyn gradually increased the number of days each month that she went to WMU without Sox. She recorded data for a year: She could only leave home alone five times during March 2015, but by March 2016, she was dog-free for the whole month. Of course she took Sox for walks in the park, like any good dog mama would do, but no more comfort doggie (service dog) needed. Extinction of fearful stimuli works!

Eye contact was a powerful conditioned stimulus eliciting such a strong, negative emotional response that Jazmyn never looked anyone in the eye—like never; head down, head turned away, any direction, to avoid eye contact. In fact, she'd do whatever she could to avoid even facing people. So during her behavior therapy sessions with Brianna, they set a timer to ring every 30 seconds, and if she wasn't looking at Brianna, she'd have to do so. And as she got better and better at maintaining eye contact with Brianna, they gradually increased the timer settings to ring less and less frequently, until the conditioned stimulus of eye contact with Brianna was no longer eliciting a conditioned fear response. Extinction of fearful stimuli works!

And does extinction of these fearful stimuli generalize to new eyes, new faces, new people?

"Yes, this seems to have generalized to almost everyone. I still find that eye contact with some people makes me very uncomfortable, but I have the skill set to 'fake it' when I need to. And now eye contact with people who elicit the greatest fear is much less of a problem than were my closest relatives and friends before the behavior therapy."

And Jazmyn was crying like five times a day, so Brianna asked her to do a variation of her muscle relaxation procedure whenever she caught herself about to cry or when she was actually crying. It worked: In the summer of 2016, she only cried once; and only once that fall. The events or thoughts or whatever that had been conditioned stimuli for eliciting such intense emotional responses that she had crying episodes, those conditioned stimuli have largely extinguished. Yes, extinction of horrible emotions works!

May 2016, Jazmyn had her act together enough that she could enroll in our practicum where we use behavior analysis to help preschool children with autism—a crucial learning experience for the children and for the college students.

How'd she do? Well she's still doing. As it is for most college students when they start the practicum, working with the children was a little intimidating. And like most college students, Jazmyn soon got over her fear of these kids and got into the groove. So now she's still grooving on; she's become one of our best behavioral technicians working with the kids, so good that, in June 2017, she entered our Behavior Analysis grad program, starting with our Behavioral Boot Camp, on the road to becoming a professional behavior analyst.

Oh yes, during Psych 1400 and for a few months after, Jazmyn had been meeting regularly with Jenna Mrljak, the doc student managing Psych 1400. But she'd never seen Jenna's face because she was always looking away, always avoiding eye contact. In late spring of 2015, they crossed paths in the psych building; Jenna said, "Hi"; Jazmyn recognized her voice and the tall blond she'd seen so often, out of the corner of her eye; but for the first time, she saw Jenna's face, her eyes, and her smile—the first time a smile had been a heart-warming experience for Jazmyn.

***PoB* 8e follow up:** As part of our grad program, Jazmyn was a grad-student instructor in Psych 1400. As of 2020, she has received her MA degree in behavior analysis and is working full-time in an educational center helping people who have extremely severe behavior problems, including people with autism and developmental disabilities.

QUESTION

1. Briefly describe the behavioral procedures to help a college sophomore reduce her fears.
   a. systematic desensitization
   b. other extinction procedures

Respondent Conditioning and the Body's Regulatory Systems

SID KICKS THE SUGAR MONKEY

Sid stepped on the scale, dreading what he was about to see. He peeked at the red numbers in the digital readout. That couldn't be right! He picked up his left foot. The numbers flickered for a minute and then settled back to the same total.

"Dawn, something's wrong with this scale," Sid said. "It says I've gained 15 pounds in the past 2 months; that can't be right."

"Sid, your clothes have looked a little tight lately; maybe the scale is right," Dawn said.

"Impossible. I eat a low-fat diet and I exercise. Nothing has changed in my fitness routine. How could I have gained 15 pounds in 2 months?"

"Nothing has changed?" asked Dawn. "It seems to me you've been drinking a lot more Coke lately."

"When?"

"Like when you're staying up all night working on your dissertation. You know Sid, one glass of Coke has 100 calories."

"But I need a caffeine fix to stay awake."

"Well, then, have your drug if you must, but at least switch to Diet Coke," said Dawn. "Then you won't be drinking so much sugar."

Sid was about to argue when he caught a glimpse of the scale again. Instead, he went to the store and bought a 24-pack of Diet Coke.

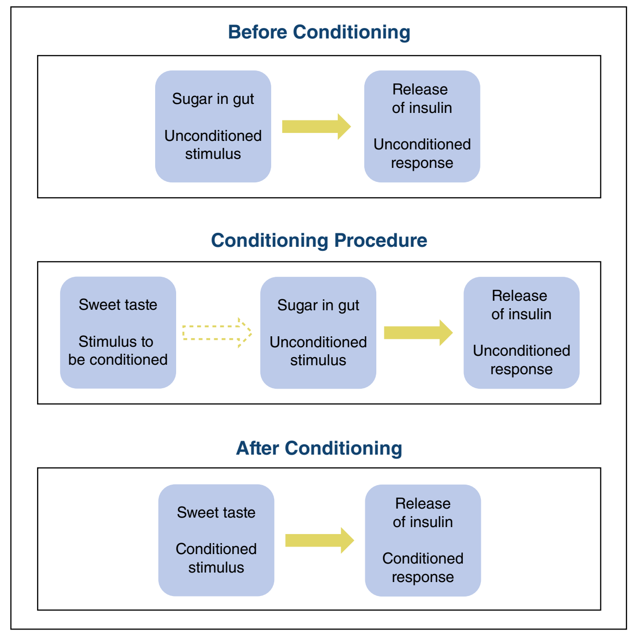
. . . Later that night . . .

"Sid, you look exhausted," Dawn said.

"Yeah, I can't keep my eyes open; I've been sitting here working on the same paragraph for the last half hour. Maybe there's less caffeine in these Diet Cokes."

Dawn remembered a study she had read in grad school. Sid was right; his lack of energy was due to his switch to Diet Cokes. But it was not because they contained less caffeine. And yes, boys and girls, it all had to do with (our sponsor for this week's episode) **respondent conditioning**. It wasn't the lack of caffeine; it was the respondent-connection deal.

When Sid drinks the sugar, that sugar in his gut is an unconditioned stimulus (US) that elicits a release of insulin by the pancreas. And the sweet taste of the sugar reliably precedes this US. So that sweet taste becomes a conditioned stimulus (CS) that also elicits the pancreas's release of insulin.



What happens when a Coke junkie like Sid switches from consistently drinking the sugar-laden Classic Coke to the sugar-free Diet Coke? The sweet taste of the Diet Coke continues to elicit the release of insulin. So? So, this released insulin was ordinarily used up in the process of digesting the sugar. But when there is no sugar to digest, the increased insulin causes the blood-sugar level to drop. And the drop in blood-sugar level causes the person to feel weak or groggy. All because of respondent conditioning.

To sum up this complex analysis: Why did Sid feel groggy? Because of respondent conditioning, the sugar-free sweet taste causes the pancreas to elicit insulin. And the released insulin brings you down because there's no extra sugar in your blood to use up the insulin during its digestion. In other words, sugar-free insulin elicitation overloads your system and brings you down.

Dawn explained to Sid that the sweet taste of the Diet Coke would soon lose its eliciting power because of respondent extinction; as long as Sid stayed with Diet Coke and the sweet taste of Coke was no longer paired with sugar in his gut, that sweet taste would soon stop eliciting the release of insulin; and, therefore, there would be no excess insulin to bring him down.

QUESTIONS

1. Describe the conditioned insulin phenomenon and diagram the respondent processes.
2. How can respondent extinction get rid of the problem?

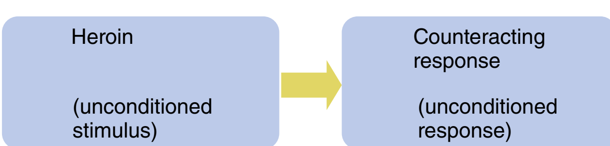
Behavioral Pharmacology

WHY DRUG ADDICTS OVERDOSE[6]

One night, instead of remaining in his living room, Famous Entertainer enters the privacy of his bathroom to shoot up heroin. The next morning's Metropolis Gazette shows a black-and-white photo of Famous Entertainer sprawled on the bathroom floor.

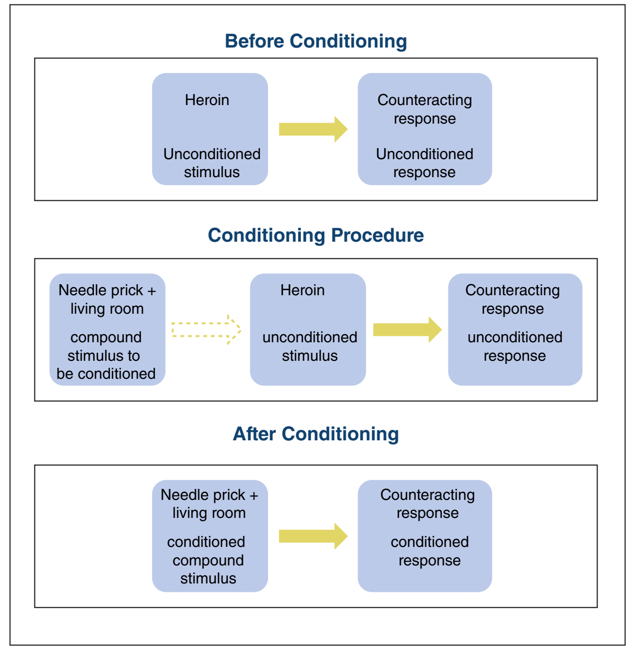
If you shoot up heavy drugs often enough, there's a good chance you'll die of an overdose, and you don't have to be a famous entertainer to do so. It turns out that overdose victims have often just injected the drug in a novel environment. But why are heavy drugs and novel environments such a fatal combination?

Some drugs (opiates, amphetamines, and cocaine) can function as a US for a very unusual UR. The UR counteracts the effects of the drug. The drug not only gets you high but also produces an unconditioned response that counteracts that high; so you need a bigger dose to actually get high.

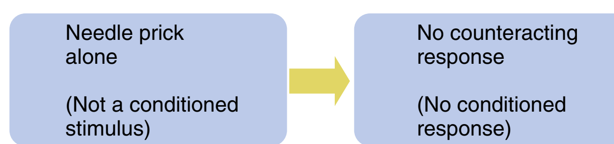


Can you see it coming? We have a US that produces a UR. Now all we need is a CS—maybe a compound stimulus, such as the prick of the needle combined with the sight of the living room. Then, after a few pairings, this compound CS also starts eliciting the counteracting effect (CR). (*Compound* is just the technical term for *combined*.)

So now, the CS produces the CR, and that combines with the UR to produce an even bigger counteraction to the main drug effect, the high. Therefore, the addict must shoot up with even bigger doses of heroin.



But what happens when he goes to the bathroom to shoot up? The compound stimulus of the living room and the needle prick is no longer there to elicit its share of the counteracting effect (the needle prick by itself won't do the trick; it has only a CS function when combined with the stimuli from the living room).



The addict takes his usual large dose, but without the protective counteracting CR. So he dies of an overdose. Fatal overdose has happened to many of my favorites, and it is so sad.*

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* Our analysis of the drug study is a little more complex than the traditional analysis of this study. We doubt that the familiar environment (e.g., the living room) becomes a CS on its own. If this were the case, the environment would elicit the CR every time the addict entered it, and then the CR would extinguish because it usually wasn't paired with the US. Instead it seems more plausible that the environment is paired with stimuli produced when actually taking the drug (such as the needle prick), and the combined stimuli become a compound stimulus. Note, however,

QUESTIONS

1. Describe the pairing procedure that causes the needle prick and sight of the living room to elicit the drug-counteracting response.
   a. What is the US?
   b. What is the UR?
   c. What is the stimulus to be conditioned?
2. Explain why going to a new environment (e.g., the bathroom) might cause a drug addict to overdose.

How to Use the Study Questions

Now we're starting to roll. But before we start rolling so fast that we get out of control, let's take a brief break and spend the next two sections discussing how to use this book. Then we can really get up to speed. We interrupt now because you may need this information to most effectively reread this chapter and read the remaining chapters.

Question

What are the main questions of the previous sections? What are the main points? What are the main goals? What are the main questions your professor might ask you on your next quiz?

Answer

The questions listed under the "Questions" headings. (Your professor will probably tell you what, if any, relation there is between our questions in the book and his or her questions on quizzes and exams.)

Whenever you finish a section or so, you should be able to answer those questions placed at the end of those sections. If you can't, then give the section another shot. Whenever you finish a chapter, you should still be able to answer those questions. So review it quickly to be sure. Whenever you take a quiz or exam, you should still be able to answer the questions. So take at least a half hour or more to review the questions for each chapter before each quiz.

But there's more to life than study questions. You also should read the sections to which the study questions refer. For one thing, it may be tough trying to memorize answers that don't make sense. A quick skim won't be enough. Carefully reading the relevant sections should put more sense into the questions, the answers, and you. For another thing, if I were your professor, I'd probably ask you a few more questions that weren't in the list of questions, just to keep you sharp. Or from a more long-range view: The questions list only the main points, not all the points. But there's more we hope you get from this book than we can test you on—for example, an appreciation of the field of behavior analysis.

In Defense of Easy Questions and Tedious Memorization

My view of the level of these study questions may shock you. They require no more intellectual skills than you'll find in your average turnip. Yet memorizing their answers requires more work than we should ask of a self-respecting college student. The study questions don't require you to think; just memorize every concept, principle, and general rule, word for word. (It doesn't have to be word for word, just perfect; but word for word is the safest.)

Why? Because of a surprising report from our best, most thoughtful, and most creative students. Over the years, they've reported that it helped them to memorize everything first. Like memorizing the vocabulary for your Spanish course. Memorize our concepts and you'll use them with greater ease, and use them you must! Then, as a result of using the concepts and principles awhile, you'll understand them. You no longer will need to worry with your memorized definitions. Memorize and you take one small but helpful step toward enlightenment.

Also, there's a good chance your instructor will be a real stickler on the quizzes. You'll define a term in a way that looks good to you, but your instructor will say, "No, you left out a word that changes the whole meaning of the definition."

"It was just one word!"

"Right, the most crucial word."

"But I was close."

"Not close enough."

---

that this is not a case of overshadowing; it's not the case that either the living room or the needle prick would elicit the counteracting CR, as would need to be the case for overshadowing to be the explanation.

"But I meant to include that word; I just forgot."

"Right. See you in class next week."

The thing is, even with years of experience in behavior analysis, we've had to spend hours defining these terms so the definitions would say exactly what they need to say. (We even had to enlist the help of many of our friends and colleagues and undergrad students too.) The odds aren't too high that you can do it casually if this is your first tour of the land of behavior analysis. (Remember, you can get our free flash cards at DickMalott.com.)

Of course, you should check with your instructor to see the exact relation between these study questions and the quizzes and tests in your particular course.

And when we ask for examples, you can just tell us the ones in the book; fine with us! They don't have to be original. Here's why I don't usually require original examples on quizzes: By itself, a textbook such as this can't get your repertoire to the point where you can reliably discriminate between examples and non-examples of concepts, let alone reliably generate correct, original examples; so we think just remembering our examples is a step in the right direction. When we use this book, we supplement it with a workbook, *How to Analyze Behavioral Contingencies* (you can also get it at DickMalott.com). That workbook trains you to creatively generate original examples and analyze novel examples of behavioral concepts. However, whether or not your professor is using this workbook, there's a good chance he or she may want you to generate original examples on the quizzes and not be satisfied with your just repeating the examples from the book. There's also a good chance he or she will tell you in advance, but you know how professors are; so you might want to check up front.

How to Read Textbooks

Follow these guidelines when you're reading any textbook:

- **Know the title of the book.** That may help you better understand what the book is talking about while you're reading it. It may help you keep the big picture. This is not the big book or the blue book; it's *Principles of Behavior*. We know one professor, Jerry Mertens, was so convinced of the importance of this knowledge that he asked for the textbook titles on his exams—not a bad idea.
- **Know the title of the chapter and section.** Remembering the chapter and section title while you're reading a section will help you understand the purpose of the examples. And remembering that will help you answer quiz questions such as What's Sid's sugar problem an example of?
- **Relate examples to concepts and principles.** Look at the concept and principle defined just before or just after an example and see how the example illustrates that concept or principle. Doing this will also help you better understand what you read and answer quiz questions.

On DickMalott.com

Want to be really cool? Then check out DickMalott.com. You'll find all sorts of stuff for the readers of *Principles of Behavior*. Huh? Come on, you know don't you; that's the book you have in your hands right now. You'll find free stuff for almost every chapter in this book.

Flash cards
Helps you with your quizzes and exams.

Homework
Helps you better understand how to apply the principles and concepts.

Workshows (computer-based homework)
Same as the above.

Advanced Study Objectives
If you want to get a little heavier into it.

Enrichment Sections
Some of it's pretty basic, some a little advanced, but all interesting, at least we think so.

Facebook
And, if we get our act together, we'll have a *Principles of Behavior* Facebook Group—we'd love to have you join.

Notes

1 Based on Jackson, H. J., & King, N. J. (1981). The emotive imaginary treatment of a child's trauma-induced phobia. *Behavior Therapy and Experimental Psychiatry*, *12*, 325–328.

2 Based on Watson, J. B., & Rayner, R. (1920). Conditioned emotional reaction. *Journal of Experimental Psychology*, *3*, 1–4.

3 Based on Lazarus, A. A. (1960). The elimination of children's phobias by deconditioning. In H. J. Eysenck (Ed.). *Behavior therapy and the neurosis* (pp. 114–122). London: Pergamon.

4 For more on Wolpe, check out. Retrieved from https://en.wikipedia.org/wiki/Joseph_Wolpe.

5 Based on Souryamat, J. (2017). Self-Management: Overcoming Barriers to Success, Honors Thesis, Lee Honors College, Western Michigan University.

6 This analysis was made by Siegel, S., Hinson, R. E., Krank, M. D., & McCully, J. (1992). Heroin "overdose" death; The contribution of drug-associated environmental cues. *Science*, *316*, 436–437.

PART II

Operant Conditioning

CHAPTER 2

Operant Conditioning for Dummies (Part I)

Behavior Analyst Certification Board 5th Edition Task List Items		
B-2.	Define and provide examples of stimulus and stimulus class.*	Throughout
B-3.	Define and provide examples of respondent and operant conditioning.	Throughout
B-4.	Define and provide examples of positive and negative reinforcement contingencies.	Pages 22–28
B-6.	Define and provide examples of positive and negative punishment contingencies.	Pages 28–31
B-9.	Define and provide examples of operant extinction.	Pages 32–33
G-1.	Use positive and negative reinforcement procedures to strengthen behavior.	Pages 22–28
G-15	Use extinction.	Pages 32–33
G-16	Use positive and negative punishment (e.g., time-out, response cost, overcorrection).	Pages 28–31

Back in the Day

OK, so way back in the 1930s, like there's this kid, just graduated from one of them ritzy eastern colleges, Hamilton College. And now he was setting off to become a famous writer, like an author, like a big deal. But he was pretty smart, and after a year of trying to become a famous author, he was smart enough to realize that wouldn't happen.

So he went to one of them ritzy eastern universities, Harvard University. And what did he do there? He put a rat in a box. You know, like Pavlov and his boys put a dog in a harness; well, this guy put a rat in a box. His name was Burrhus, the kid's, not the rat's. I don't know what kind of parents would name their kid Burrhus, but this kid was smart enough to have his buddies call him by his middle name, Fred. Oh yes, and the rat's name was Rudolph, Rudolph the Rat.

So Fred put Rudolph in the box and also stuck a lever in the box. And every time Rudolph pressed the lever, Fred would give him a little pellet of food. And I'll bet you can guess what happened next—the rat started pressing the lever about as fast as he could, until he was full; then he'd stroll over to the corner and take a nap. No big deal, right? But guess what happened to Fred.

Harvard University thought it was such a big deal that they gave Burrhus Frederic Skinner a PhD, a PhD from the most prestigious university in the world! And after a few more years of putting rats and pigeons in Skinner boxes, B. F. Skinner became the most famous psychologist in America. Really! And he still is. (Yes, we call them Skinner boxes.)

And that's what this whole book is about, the implications of that little rat's pressing the lever, way back in the 1930s—the implications for you and for me, and other people even weirder than you and I are, and other people with even more problems than you and I have, and, for sure, other people a heck of a lot more successful than you and I are.

And those implications are not only in terms of understanding why we're so weird, or have so many problems, or are so successful; this book is also about how you can help people become a little less weird, if that's what they want, how you

* Many of the concepts and terms on the task list will be used throughout this book. We'll list them at the start of any chapter that discusses something new about that topic. But they will often pop up in other chapters, so we highly recommend reading through the whole book to gain a thorough understanding of all the basic principles of behavior analysis.

can help them have fewer problems, and how you can help them become more successful.

And here's something even more far out: By the time you've finished reading this book, a few of you will choose to devote the rest of your life to playing with Rudolph in Skinner's box. And even more of you will choose to devote your life to using what you learn in this book to help other people live healthier, happier, more productive lives. Really!

(Author's Note: You have to cut me a little slack: Skinner didn't really name his rat Rudolph; I did, because I can't resist an occasional alliteration [yeah, Google "alliteration," if you really care].)

QUESTIONS

1. What did Skinner do that made him so famous?
2. And how does that relate to this book?

As Weird as Sex

Remember how disgusting and weird having sex seemed, the first time you heard about it? Like do people really do that?! And they enjoy it?! Sick!! So, my guess is that several of you have changed your mind since then.

Well, my guess also is that you think playing with Rudolph the Rat in a Skinner box is about as disgusting as you used to think having sex was. And remember how that sex thing has turned out. Same with Rudolph in the Skinner box. Like a week ago, I was at this international conference on behavior analysis, ABAI, in Denver, and this old, retired college professor came up to me and said, "You know, that Skinner-box rat lab you had me take 48 years ago? Well, that's the best thing that ever happened to me; that's what got me turned on to behavior analysis; and that's why I spent the rest of my professional career teaching behavior analysis to college students."

And a few years before that, another WMU alum told me much the same thing. Rudolph the Rat's what turned her on to behavior analysis, why she switched her major from speech path to psych, why she's been spending her life using behavior analysis to help children with special academic problems, why she's been teaching special ed majors to use behavior analysis to help students, and why she's been one of the most productive research scientists in our field. Yeah, and she started out as just a lost little girl in a rat lab.

(Authors' Note: What's *behavior analysis*? It's what this book is all about. It's the science, the practice, and the philosophy of following up on Skinner's little rat in the box! Don't worry; it'll all make sense to you before too long.)

OK, if your instructor really loves you, she will have a rat lab for you to work and play in while you read this book. However, she probably doesn't love you that much. But don't give up. You can build your own rat lab. Where? In your dorm room or your apartment, of course.

Oh, that's scary!

Silly, I don't mean one of those nasty rats you catch in the alley; I mean one of those cute little lovable rats you buy at a pet store.

But they won't give me permission to have a rat in the dorm, or the apartment building, or the van I live in down by the river.

Of course not, dummy; that's why you don't ask for permission and why you sneak Rudolph in after dark.

The idea of a rat still freaks you out? OK, get a canary, or a goldfish. Yeah, you can build a little Skinner box for them too. Or your pet doggie or kitty cat. Yes, or even a monkey; I had a friend who did that too, in his apartment in New York City. (You can find all these Skinner box animals on YouTube.) But, if you get in trouble with your dorm or apartment managers, I don't even know you. However, if you do it, you'll love it—probably.

Note: The above is not meant to suggest that the rat lab will turn out to be as much fun as sex, at least not for most of you. But it will be fun, it will be cool, and it really might transform your life.

QUESTION

1. Sorry, no questions.

Becoming a BCBA—First Step

Many of you are taking this course to fill some silly requirement or other; you roll your eyes and say, "Whatever." But watch out, because this course with this book is liable to sneak up from behind and grab you when you're not looking. By the end of this course and this book (*Principles of Behavior*, a.k.a. *PoB*), some of you are going to say, "Wow, this has really turned my head around. When I started to read this book, I had no idea what behavior analysis was and could care less. But now I know what it is, and I want to do it—for the rest of my life—maybe. I want to become a professional behavior analyst." But right now, you skeptics are saying, "Yeah, right; give me a break!" Well, be careful; and remember, we warned you.

We've written *PoB* to turn you on to the principles of behavior and behavior analysis; we've written it so you'll understand all the principles of behavior; we've written it so you'll be able to understand how the behavioral world, our psychological world, works; we've written it so you can get ready to use the principles of behavior to build a better world; and we've written it so you, if you want, can take the next step toward becoming a professional behavior analyst; and some of you will want to take this next step.

Others of you already know you want to become professional behavior analysts; and if you want to become a behavior-analyst practitioner, you'll probably want to become a Board Certified Assistant Behavior Analyst (BCaBA) when you get your bachelor's degree or even a Board Certified Behavior Analyst (BCBA) when you get your master's degree. And a few of you may end up getting your doctorate degree and your BCBA-D! And if you want to quit your job waiting tables and do something more exciting while you work on those degrees, you might even consider becoming a Registered Behavior Technician (RBT)—easy to do.

Well, to become certified, at whatever level, you'll need to pass the certification exam; and you'll need to really know the principles of behavior to pass that exam. But you're in luck; not only is this book an outstanding introduction to the principles of behavior, we think it's all you'll need to pass major sections of that exam, the foundational sections. People who studied for the exam, and people who teach people studying for the exam, have said this book is the best resource available. Therefore, starting with the 7th edition of *Principles of Behavior* (*PoB*), we've been making our book even more certification-exam friendly, so that you can easily find the sections relevant to each of the tasks listed in the BACB's Fifth Edition Task List in the appendix (p. 476).

Not interested in becoming a certified behavior analyst? No problem; our cues for the certification exam tasks are unobtrusive; you can ignore them and keep right on reading. But be careful, because by the time you get to the end of the book, you too may have decided you want to become a certified behavior analyst!

QUESTION

1. What's a/an
   a. RBT
   b. BCaBA
   c. BCBA
   d. BCBA-D

Example of a Positive Reinforcer
Behavioral Child and Family Counseling

FAMILY LIFE—PART I[1] (B-4)

The baby's scream sounded like someone's fingernail scraping over a chalkboard. Sid Fields pounded his fists on the battered computer, jumped up from his desk, and ran into the nursery. Fortunately, Dawn got there before him. She picked up their crying baby, hugged him, rocked him, cooed him, and then said to her husband, "Sid, calm down. Rod will be asleep in a minute."

"That kid's driving me crazy," Sid said. "I'm having enough trouble getting my PhD dissertation written without having to put up with Rod's constant crying."

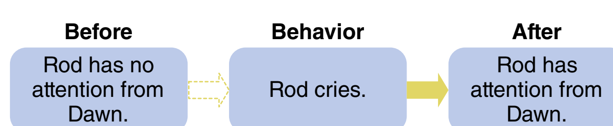
"Sid, he's just a baby."

"He's going to be a baby with an unemployed father if I don't get my dissertation written. You know the chair of our department said he couldn't rehire me if I don't finish my dissertation and get my doctoral degree by the end of this year."

"You'll get your doctoral dissertation written, Sid. I know you will." Dawn put her right arm around Sid's waist, while she continued to cradle Rod in her left arm.

"Shhh, Rod's asleep now," Dawn said, as she gently laid their baby back in his crib.

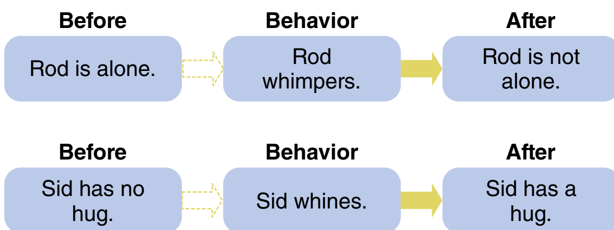
Dawn took Sid's hand, and both smiled as they looked down on their sleeping son. Then they started to leave the room as quietly as they could. But before they'd reached the door, Rod started whimpering. So they sat on the floor of the nursery, waiting for their son to fall asleep again. Their smiles had disappeared, and they began talking in low voices. "You know, Dawn, I think you increase Rod's crying each time you pay attention and cuddle him when he cries."*



* **Student Tip 1:** If you want to nail these diagrams and the powerful conceptual understanding that lies behind them, you need our *Contingency Diagramming Checklist*. Just visit DickMalott.com, where you'll find it for free.

"I think Rod cries because we pay attention to him every time he does. We run into his room every time he even whimpers."*

"What about my giving you a hug when you were so upset about your dissertation? Is that why you're always complaining?" Dawn smiled and took Sid's hand.



"I wasn't complaining about my dissertation; I was stating a fact."

Dawn thought, even if the shoe fits, Sid refuses to wear it. She said, "I have a PhD in behavior analysis, and you will too, before long . . ."

"Let's hope!"

"I earn my living using behavior analysis to help other people," Dawn continued. "And yet, why can't I use behavior analysis to help my own family? Surely we can figure out how to use behavior analysis to help Rod stop crying and causing such a fuss. Surely we can figure out how to help him stop making life so hard for all three of us."

"What about a little help on my dissertation, too?"

"OK, we've also got to figure out how to help you get over your so-called writer's block and finish your dissertation so you can keep your job in the Psych Department."

Two hours later, Rod was sleeping soundly enough that his parents could finally slip out of his nursery without his starting to cry again, but now Sid was too tired to work on his dissertation.

If the behavior analysts, Sid and Dawn, had known you'd be reading their conversation, they would have used the technical term *reinforcer* when talking about the attention that Rod got when he cried and Sid got when he complained.

Definition: CONCEPT

Positive reinforcer (reinforcer)**

- A stimulus
- that increases
- the frequency
- of a response it follows.

For example, Dawn and Sid's attention and comfort immediately followed Rod's response of crying and increased the frequency of his crying. So attention and comfort are a reinforcer for Rod's behavior.*** And there's a good chance that Dawn's immediate attention and comfort when Sid whined was a reinforcer that increased the frequency of his whining.

Here's another example: It might be a big reinforcer for you to see the crucial concepts in this book highlighted in yellow. If so, now's the time for you to make the response of picking up that yellow highlighter and then make the response of highlighting those crucial concepts. So, by "response" we mean "behavior" or "activity," and we tend to use those three terms interchangeably.****

* These contingency diagrams will be explained in detail throughout the book. For now, notice the lines between the boxes. A dashed line indicates a temporal relationship (what's in the first box, *before*, **occurs before** the *behavior* in the second box). A solid line with an arrow indicates that the *behavior* **causes** what comes *after*. In this case, Rod has no attention *before* he cries, and his crying *behavior* **causes** the *after* condition of his receiving attention. And for those of you who already have some familiarity with behavior analysis, our *before condition* is not the same as the more traditional *antecedent condition* of the antecedent—behavior—consequence (ABC) model. For example, *before condition* doesn't include discriminative stimuli, which we deal with separately in Chapter 14.

** In a few of our definitions, we put in parentheses an alternative term for the one we're defining. Our alternative is one that is commonly used and sometimes our preference, but don't forget the term that's not in the parentheses, because that's the official one.

*** The infant's crying raises an interesting problem—the cry-wolf phenomenon. The infant's crying is a functional escape response because it will bring a watchful parent to the rescue when the diapers are wet. Watchful parents will also reinforce crying when the child is hungry. But crying can become dictatorially dysfunctional, when parents unintentionally reinforce crying with attention and comfort every time it occurs. It's not always easy for the outsider to discriminate between functional and dysfunctional crying, though many parents learn that discrimination. And also, it's not always easy to be a parent.

**** **Student Tip 2:** If you want to nail the concepts and principles in this book (boxed definitions), you need flash cards. And, if

THOSE DARNED BULLET POINTS

Notice the bullet points in the preceding boxed definition of "positive reinforcer." We have them in all of our definitions, but most students hate them (ah, let's be honest; all students hate them). But they're your little friends. Let's look a little more closely:

Positive reinforcer

- A stimulus (it's not a response)
- that increases (it doesn't decrease)
- the frequency (not the latency)
- of a response it follows (not precedes).

In other words, to understand this concept, you've got to understand that it has four crucial features; and you've got to understand what those features are and what they are not. (We'll return to this in a minute or two.)

QUESTION

1. *Positive reinforcer*

a. Define it and
b. Diagram how it could cause problem behavior

i. in a child
ii. in a parent

Example of Positive Reinforcement Behavioral Social Work and Behavioral Gerontology

THE GRANDFATHER[2] (B-4)

John "Juke" Jackson enjoyed telling people he was the first Black student to receive a master's degree in organizational behavior management at Big State University. His audience would always show how impressed they were with his success. And they would always comment on what a scandal it was that BSU was so racist. Why had BSU waited so long to allow a Black student to graduate from that program? Then Juke would laugh and tell them he was the first student, either Black or White, to enter that program.

But he didn't bother to tell them he had graduated with straight *A*s, and in only 16 months, from a 24-month program; no one had yet come close to his record. And he didn't tell them he was the first football player to earn a graduate degree from any program in the Psych Department or that he also had a graduate minor in sports psychology.

He didn't tell them he drove a new Mercedes and lived in the second-most-expensive condo in town. He didn't tell them he spent as much time coaching kids in sports for no pay as he did coaching managers in business and industry for more pay than he ever imagined he'd earn.

And he didn't tell them he cried for an hour without stopping when his mother called to tell him his grandfather had had a stroke and that his right side was paralyzed. His grandfather had taught him how to throw a football. His grandfather had come to every game he'd played from junior high through college. His grandfather had paid for his books and tuition in grad school. His grandfather had always had a joke for him.

Juke's heart was broken when he saw the old man lying in the intensive care unit. His grandfather no longer had a joke for anyone. He just lay there staring at nothing. This wasn't someone else's grandfather; this was Juke's grandfather. Juke didn't know a football star and the hottest man in organizational behavior management could cry so much. Juke, the man of many cool moves, had no moves.

Four weeks later, Juke, in an impeccable $1,700 suit and his new Mercedes, again headed 3 hours south, to his hometown. The grandfather was in his own house now, sitting in an antique rocking chair. Just a few months ago, the old man had run out of the house to greet him, even before Juke had time to get out of his car. Now he didn't even get out of his rocking chair. He just sat there, staring at nothing.

"That's the way he is," Juke's grandmother said. "He just sits there. And when he does talk, he doesn't make any sense. He's no better than he was in the hospital. John, honey, will he always be like this? Won't he ever get any better?"

Juke didn't trust his voice to reply. He hugged his grandmother and hid his eyes.

The grandmother went into the kitchen to prepare dinner. Juke sat and watched his grandfather. Only once during the next

you want to nail the tests over this book, you need flash cards, depending on how rigorous your teacher's tests are. However, making your own flash cards for the 200+ definitions in this book would be a real hassle. And your teacher may not love you enough to make the flash cards for you. But, Uncle Dickie loves you. So just go to DickMalott.com, click on the picture of this book, and you'll be able to find 'em there—free.

hour did the old man say anything spontaneously—something about the snow outside, though it was May. Juke questioned his grandfather several times, trying to get him to talk. The old man would answer, but often his answers made no more sense than snow in May.

Like the rest of his gang from BSU, Juke was a thoroughgoing, 24/7 behavior analyst. He naïvely believed that, with behavior analysis and hard work, he could solve all the world's problems. At least he hadn't found any he couldn't solve. So, the man of many moves began to make his moves.

"Grandma, here's what I think we should do."

"I'll do anything you say, honey, 'cause I can't stand it like this. He doesn't get any better. He just sits there."

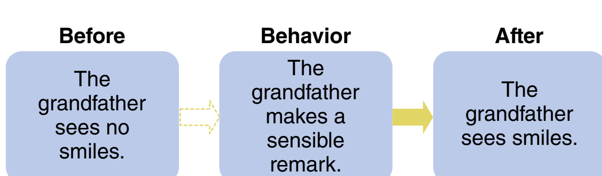
"OK, Grandma, now we're going to start a reinforcement program. I want you to set aside an hour each day where you just concentrate on this program. Every time Grandpa makes any remark, I want you to count it. And I want you to ask him a few questions to try to get him to talk. Keep track of the number of times his answers make sense and the number of times they don't."

Juke started to tell his grandmother this would be the baseline period but instead said, "We'll just keep track of things for a few days. That way we can see if Grandpa can get better, on his own. And we can also see if he's really improving once we start to try and help."

"Honey, I know your grandpa isn't getting any better."

Grandmother was right. Though Juke insisted on a few weeks of baseline, his grandfather averaged less than one spontaneous remark per hour, and only 67% of his comments made sense.

So Juke made his next move. He set up what he hoped would be a reinforcement procedure. For 1 hour each day, the grandmother attempted to reinforce spontaneous remarks and sensible answers. Each time the grandfather responded properly, the grandmother would smile, say a few kind words, and caress the old man. But she caressed only the left side of his head and body, where he could still feel her touch. Juke hoped the smiles, kind words, and caresses would act as reinforcers for his grandfather.



Definition: CONCEPT

Positive reinforcement contingency (reinforcement)

- The response-contingent
- presentation of
- a reinforcer
- resulting in an **increased** frequency of that response.

This last clause in the definition, *resulting in an increased frequency of that response*, is usually a little redundant, because if a reinforcer is presented, the frequency of that response should increase, almost by definition. But redundancy in the name of effective teaching is a virtue, not a vice.

(Tech Talk: So, when a regular person gives rewards to someone for doing something and the person's more likely to do it the next time around, we call that *cool*. But when a behavior analyst gives a reinforcer right after a behavior and the behavior increases in frequency, we call that *reinforcement*. And because we're *adding* something following the behavior, we call it ***positive*** *reinforcement*. And *a reward ≈ a reinforcer* and *to reward ≈ to reinforce*. Oh yes, and if it's been a little while since you had algebra or whatever, "≈" means "approximately equal." Got it?)

By the way, ***contingent*** is just a fancy way of saying *dependent* or *caused by*. For example, Juke's praise was contingent on, or depended on, his grandmother delivering reinforcers immediately after the sensible remarks. And getting a drop of water is contingent on, or depends on, Rudolph's pressing the lever. And this cause-effect relationship between the response and the reinforcing praise or the water is a *contingency*.

And what's a ***behavior analyst***? The person who professionally studies and uses behavior analysis, of course, you know, like you may be doing, if you're not careful.)

Juke coached his grandmother, just as he coached the athletes and the managers. He told her what to do. He showed her what to do. He had her practice. He praised her when she did it right and suggested corrections when she didn't. (Nowadays, we call this **behavioral skills training**.) It took a few sessions before she was delivering her reinforcers immediately after her husband's sensible responses. But Juke was as patient and as effective in improving the skills of his grandmother as he was with everyone else he coached. Juke was the master of the praise contingency, putting that praise at just the right place at just the right time—immediately after the correct response or an approximation to the correct response.

The Mercedes made the 3-hour trip every weekend. Juke plotted the data his grandmother had recorded, showed her the graphs, watched her working with his grandfather, praised her appropriate efforts, and suggested concrete changes. He also ate his share of his grandmother's cooking and put on a couple of pounds over those weekends.

During the next 6 weeks, grandfather's spontaneous remarks rose from less than 1 to 2.5 per hour, and his sensible replies rose from 67% to 84%. Now it was time to help his grandmother maintain the reinforcement program more independently. Juke replaced his visits with weekly phone calls and then stopped the calls, asking his grandmother to call whenever she had any questions. At Christmas time, his grandmother was still faithfully maintaining the program on her own, and his grandfather was maintaining the same reasonably high rate of spontaneous and sensible remarks as he had when Juke had been helping with the reinforcement procedure.

Christmas was bittersweet that year. The grandfather was not as he had been the Christmas before, but he was much better than in May and June. Juke's grandmother said, "John, I thank the Lord I've got such a fine grandson as you. I don't know what I'd have done without you, honey." Juke covertly wiped a tear from his eye.

Those Damned Bullet Points

Positive reinforcement (reinforcement contingency)

- The response-contingent (it's contingent or dependent, **not independent**)
- presentation of (**not removal of**)
- a reinforcer (**not a punisher**)
- resulting in an increased frequency of that response (**not decreased**).

If it were "the response-contingent presentation of a **punisher** resulting in a **decreased** frequency of the response," it would be a **punishment** contingency, not a **reinforcement** contingency. And if you left out one of the bullet points, the definition wouldn't make much sense.

QUESTIONS

1. *Positive reinforcement*—define it.
2. Briefly describe the use of positive reinforcement to improve functioning of stroke victims. Describe:
    - the behaviors
    - the reinforcers
    - the procedures
    - the results

Example of Negative Reinforcement (Escape) Behavioral Medicine

DR. YEALLAND'S CHAMBER OF HORRORS[3]

During World War I, Ed fought as part of the U.S. Army in France. In one battle, several of his friends were killed. When he was finally rescued, Ed said his right leg felt weak. Within an hour, he couldn't move his leg at all; he broke out in a sweat each time he tried. His leg had become rigid and sometimes trembled.

In the spring of 1917, Ed came on crutches to see Dr. Yealland. Yealland listened thoughtfully to Ed's story as he examined Ed's leg. Then Yealland did a strange thing. He walked to the door of his office, the only exit from the room, and locked it securely. Turning to Ed he said, "Ed, I don't know the exact cause of your paralysis, but apparently the tissue is OK. It is a subtle problem of the muscles and the nerves, but one I can treat. We'll stay in this room until I've cured you." With that, Yealland walked across the room to a metal cabinet where he carefully opened several drawers. Various pieces of apparatus lay within. An electric generator was alongside. Before reaching into the drawer, he hesitated and turned to Ed.

"I can see," he said, "that your muscles have become antagonistic. By the proper stimulation, we can alleviate this condition. I'm going to apply a faradic stimulator to your leg."

He withdrew a roller-like object and, turning on a switch, applied it to Ed's paralyzed leg. Ed's muscles jerked as electric current passed throughout his leg, but the leg itself remained motionless. Yealland withdrew the roller and applied it again. After several such applications, Yealland said, "The muscles seem joined in their antagonism; therefore, I must increase the intensity of the faradic stimulation."

With some ceremony, he turned up the dial and again stimulated Ed's leg. Soon he saw a slight movement in the leg. He immediately pulled the roller away.

"Aha," he said, "movement." He increased the intensity and applied the roller again. This time the movement was greater. Again, he immediately withdrew the roller.

"Aha," he said again, as he further increased the intensity of the electricity.

After 10 minutes of this procedure, Ed said he could move his leg without any more stimulation. Yealland quickly removed Ed's crutches and asked him to place weight on the leg. Ed did so, cautiously at first, but with little trouble.

Yealland looked at Ed and smiled, "This condition should bother you no longer. Of course, if it does come back, I'm always here. I am always ready to give you further treatment. If, on the other hand, the cure remains intact, I'm sure you will be happy to leave the hospital and resume your life as a civilian."

As he prepared to leave the office, Ed grabbed the doctor's hand and, shaking it with enthusiasm, thanked him for his help. Taking one last look at his crutches lying in the corner, he strode boldly out the door and returned to his ward. A week later, he left the hospital and went back to his farm in Iowa.

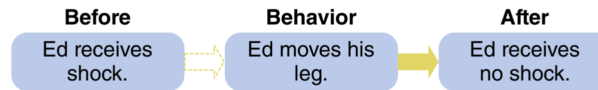
Yealland had used this intervention with dozens of veterans suffering from the same sort of problems. In all but a few cases, he had complete success. In his few failures, other doctors later found previously undetected tissue damage that caused some of the problems.

Analysis in Terms of the Negative Reinforcement Contingency (B-4)

In the past, people used "shell shock" to refer to these common problems among veterans. Shell shock didn't always mean shock from exploding shells. Often it referred to a process that took place as time and experience in combat lengthened. Physicians used the label "shell shock," for example, when combat soldiers suffered blindness, deafness, or paralysis without any trace of physical damage. The problem was behavioral, not physical; but it caused great suffering, nonetheless.

Yealland developed a complex theory to explain the shell-shock phenomenon. But we won't focus on his theory, because it makes no sense at all to modern medicine. However, this does not detract from Yealland's great success with his clients. Without his treatment, many veterans would have spent their days in military hospitals, confined to wheelchairs or in cheerless and somber seclusion.

Yealland's procedure didn't involve basic principles of medicine; instead, it involved a basic principle of behavior—negative reinforcement—*reinforcement by the removal of a negative reinforcer*. The removal of the electric stimulation (negative reinforcer) reinforced Ed's leg movement.



Definition: CONCEPTS

Negative reinforcer (aversive stimulus)

- A stimulus
- that increases the future frequency of a response that
- its **removal (termination)** follows.

Negative reinforcement contingency (escape)

- The response-contingent
- removal of
- a negative reinforcer
- resulting in an **increased** frequency of that response.

Put another way, the removal or reduction of a negative reinforcer, contingent on (caused by) a response, reinforces that response; as a result, the frequency of that response increases. Because we're **removing** something, we call this **negative** reinforcement. We might also refer to this as escape. An escape response is one that removes or reduces a negative reinforcer. So, the movement of Ed's paralyzed leg was an escape response that removed the negative reinforcer (the shock).

At first, you might think of escape behavior only as behavior involving your leaving the place where the negative reinforcer is. For example, you escape from the heat by moving out of the bright sun and into the cool shade. But as you think about it, you'll realize that escape behavior also can involve removing the negative reinforcer from the place where you are. For example, you escape the extreme heat in your house by opening a couple of windows and letting a refreshing breeze blow through; you may not have to escape from your house.

Those Helpful Bullet Points

Negative reinforcer

- A **stimulus?** or **response?**
- that **increases?** or **decreases?** the future frequency of a response that
- its removal (termination) **follows?** or **precedes**?

You've got to know each of those crucial words, or you don't really know (understand) the concept. And we're betting that dividing each definition into its component (bulleted) parts helps you identify those crucial components.

Negative reinforcement contingency (escape contingency)

- The response-____________
- _______ of
- a(n) ________ stimulus
- resulting in a(n) _________ frequency of that response.

QUESTIONS

1. *Negative reinforcement (escape)*—define it.
2. Give an example of negative reinforcement. Describe:
   - the negative reinforcer
   - the behavior (response) that escapes the negative reinforcer
   - the client
   - the results

Example of Positive Punishment Behavioral Medicine

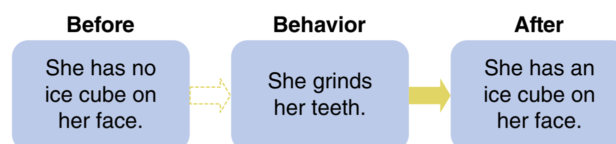
BRUXISM[4]

Thirty-two-year-old Velma was born deaf and with both eyes sealed shut. In addition, she had a profound mental impairment. She also ground her teeth—a behavior called *bruxism*. She had been grinding her teeth for at least 14 years. She had lost all but five of her upper teeth (a dental consultant said this probably resulted from her bruxism). She still had a full set of lower teeth.

Sixteen-year-old Gerri couldn't walk and also had a profound mental impairment. She had been grinding her teeth since she had had them. She had not yet lost any of her teeth, but the biting surfaces were severely worn.

Their teeth grinding had many bad effects: It was destroying their teeth. It probably produced headaches. They more frequently cried and had tantrums during high periods of teeth grinding (possibly because of the resulting headaches). They were less responsive to training programs while grinding their teeth. And the sound of their teeth grinding and their unresponsiveness were so aversive that the teachers and direct care staff preferred not to work with them.

The behavior analysts who worked with Velma and Gerri were Ronald Blount, Ronald Drabman, Norma Wilson, and Dewanda Stewart. They considered using various complex reinforcement techniques to reduce the teeth grinding, but none seemed likely to work. So, they selected a mild punishment. It consisted of touching the client's face with an ice cube for a few seconds each time she audibly ground her teeth. To protect the rights of clients, most institutions have review panels that must approve interventions that are experimental or use negative reinforcers. So, the behavior analysts obtained both the approval of the review panel and the informed consent of the parents before starting their intervention.



Both Velma and Gerri decreased their teeth grinding within the first few days of the ice cube punishment contingency. After 2 months with that contingency, they had stopped grinding their teeth almost completely (Figure 2.1).

For both women, several good things happened because of their reduced teeth grinding. For example, Gerri laughed and played more. Her mother was happier to have her home on weekends, as Gerri was more sociable and not constantly making the irritating sound of her teeth grinding. Teachers and direct care

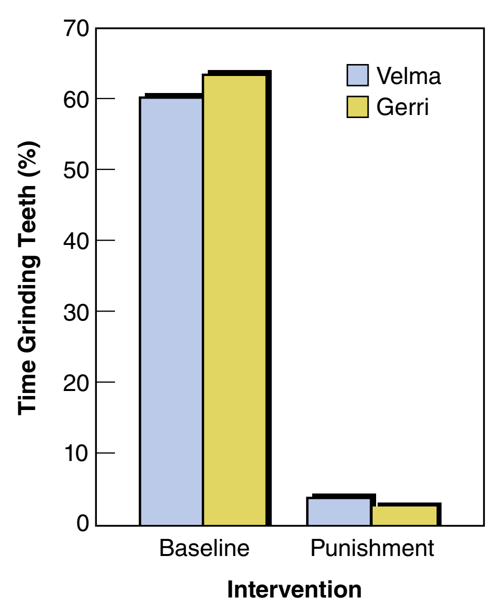


Figure 2.1 Ice Cube Punishment of Teeth Grinding

staff said the same thing. Also, the teachers said she was more cooperative and, therefore, learned more rapidly. And everyone was willing to spend more time with her than before.

(Tech Talk: The procedure these behavior analysts used was called positive punishment. We use the term *positive* to indicate that we've *added* a punisher [aversive stimulus/negative reinforcer] immediately after all or some of the responses, in order to decrease that behavior in the future. In other words, the added punisher is contingent on the response. *Positive* means *added* in this context, not that it is something positive or nice from the receiver's point of view.)

Definition: CONCEPT

Punisher (aversive stimulus)

- A stimulus
- that decreases the future frequency of a response that
- its **presentation** follows.

Positive punishment contingency (punishment)

- Response-contingent
- presentation of
- a punisher
- resulting in a **decreased** frequency of that response.

And when we behavior analysts use the technical term *punisher*, we mean the aversive stimulus in the punishment contingency, not the person applying the contingency. So the ice cube on the face would be the *punisher*, not the person applying the ice cube.

QUESTIONS

1. *Positive punishment*—define it.
2. *Punisher*—define it.
3. Diagram the positive punishment contingency to get rid of bruxism (teeth grinding). Describe:
    - the intervention
    - the results

Remember: To do well on the quizzes, you must be able to diagram all the interventions described in the chapters.

Example of Negative Punishment (Penalty) Behavioral Juvenile Corrections

FEAR AND LOATHING IN THE SCHOOL SHOP[5]

"Mark, I'm gonna kick your butt!" Herb said. Mark had bumped Herb's elbow (maybe accidentally, maybe not). Herb was having enough trouble following the pattern using the jigsaw, without hassles from Mark.

Mark picked up his hammer. "No you ain't. You try it, and I'll kill ya!"

"Boys, that's no way to talk," Bruce Black, the fifth-grade shop teacher, said.

Herb looked at Mark. "Yeah, and I'm gonna smash your woodworking project too."

"Boys, stop that kind of talk."

"Mr. Black, I ain't gonna stop it, and you get outta my face, or I'll smash you, too."

After several weeks of problems of this sort, Bruce went to see the Rosa Parks Academy principal. "Dr. Robinson, I don't think it was a good idea to let those juvenile delinquents into our school. They're completely out of control. I can see why the court sent them to that Achievement Place home. They steal, they fight, they disrupt—when they come to school at all. They're the hardest 13-year-olds I've ever seen! They almost scare me."

"What are they doing?" Mae Robinson asked.

"They have so much aggression inside them that they keep exploding."

Mae asked, "Can you tell me more specifically what they do?"

"Well, they're very aggressive, with each other and even with me."

It sure is hard to get people to talk about specific behaviors and not talk in the vague terms that make intervention difficult, Mae thought. "Bruce, what specific things do they do that are aggressive? Do they hit each other?"

"Sometimes. But it's not so much hitting; it's more that they're constantly threatening violence and destruction."

"That's our boys, all right. Their threats are a big part of what got them classified as pre-delinquents in the first place. I have an idea about what we should do that may help those kids."

Mae* explained to Bruce that the group home for juvenile offenders, where the boys lived, used the Achievement Place approach, an approach developed by Drs. Montrose Wolf and Elery Phillips and their team at the University of Kansas. In the group home, the boys earned points for good behavior and for productive behavior. They lost points for bad behavior. The points were reinforcers because the boys could use them like money at the group home. They could buy things with them, like permission to use the bikes, watch TV, eat a snack, go downtown, stay up past bedtime, and come home late after school.

Phillips had published his master's thesis on the use of this point system. In one of his studies, he had used a negative punishment (penalty) procedure involving the loss of points to get rid of the threats the boys were always making.

Bruce agreed to try Phillips's procedure in his shop.

Back in the shop:

"This school stinks. I'm going to blow up the whole damned thing!" Mark said.

"Mark, that threat cost you 50 points," Bruce Black said, in as calm a voice as he could manage with his heart pounding as fast as it was.

"Fifty what?"

"We're working with your group home. They've given us permission to dock any of you boys 50 points whenever you threaten violence or destruction." I hope it works, Bruce thought.

"Fifty points! I'm gonna blow up the home, too!"

"That's another 50 points." Gosh, I hope it works.

Before	Behavior	After
Mark has all his points.	Mark threatens.	Mark loses 50 points.

It did work. Mark went from over eight threats an hour down to none after Bruce Black used the negative punishment procedure for a few classes. The others improved much the same way. Within a few classes, negative punishment had completely gotten rid of the threats of violence and destruction that had filled the air (Figure 2.2).

And the boys were one small step closer to acting in a way that would keep them out of trouble with the world and give them a chance to lead a normal, decent life, rather than the sad life of the petty crook.

(Tech Talk: In everyday English, we'd say *penalty*; but behavior analysts say *negative punishment*, because we're removing something, in order to decrease the boy's threats.)

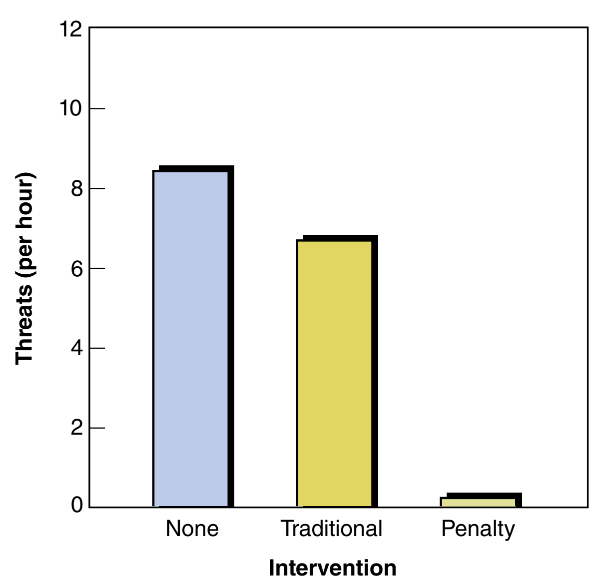


Figure 2.2 Using Negative Punishment to Reduce a Pre-Delinquent Boy's Threats

* The main fictional characters in this book, Mae, Dawn, Juke, and Sid, are practitioners or service providers rather than researchers. They don't do basic research or applied research to contribute to our knowledge of the principles of behavior and the evidence-based best practices behavior-analytic practitioners should use when working toward the well-being of all of us, including animals as well as human beings. Instead, as evidence-based practitioners, they try to rely on the principles of behavior the basic researchers have discovered and "proven." In addition, they try to rely on the best practices the applied researchers have discovered and "proven," as you will see, throughout this book. However, most of the references in this book are to the basic and applied researchers whose work our evidence-based practitioners refer to.

Definition: CONCEPT

Negative punishment contingency (penalty)

- Response-contingent
- removal of
- a reinforcer
- resulting in a **decreased** frequency of that response.

QUESTIONS

1. *Negative punishment (penalty)*—define it.
2. Describe the use of a negative punishment procedure to reduce inappropriate social interactions. Describe:
   - the person whose behavior was modified
   - the undesirable behavior
   - the reinforcer used
   - the contingency
   - the results

THE FOUR BASIC BEHAVIORAL CONTINGENCIES

Time for a little summary of all this complex stuff. We've been talking about **behavioral contingencies**. A contingency is a *causal relationship*.

There are two general types of behavioral contingencies, **reinforcement** and **punishment**:

Reinforcement contingencies **increase** the frequency of behavior, and
punishment contingencies **decrease** the frequency of behavior.

And there are also two types of reinforcement and punishment contingencies:

positive and **negative** contingencies:
positive contingencies involve the **presentation** of a stimulus, and
negative contingencies involve the **removal** of a stimulus.
Positive reinforcement is the **presentation** of a **positive reinforcer** (e.g., food).
Negative reinforcement is the **removal** of a **negative reinforcer** (e.g., shock).
Positive punishment is the **presentation** of a **positive punisher** (e.g., shock).
Negative punishment is the **removal** of a **negative punisher** (e.g., food).

So, the crucial pairs of words are **positive** & **negative**, **reinforcement** & **punishment**, **present** & **remove**, and **increase** & **decrease**. Your job is to be able to combine one word from each pair so that it makes behavior-analytic sense. So, go for it.

Now we behavior analysts have dug ourselves into a whole hole. And we started recognizing this when Skinner informally said he wished he had never invented the term *negative reinforcement*, because it confuses so many people. (Yeah, and you probably wish he hadn't too, but here we are stuck with it.)

And from that we have *positive* and *negative reinforcer*. I prefer *reward* and *aversive stimulus*. Generally, if something is a ***reward***, it will function as both a *positive reinforcer* and a *negative punisher*. And if something is an ***aversive stimulus***, it will function as both a *negative reinforcer* and a *positive punisher*. In other words, food will usually be both a positive reinforcer and a negative punisher, and electric shock will be both a negative reinforcer and a positive punisher. But concerning what terms to use, when you're talking tech with a behavior analyst or taking the BACB exam, you might want to keep those two—*aversive stimulus* and, especially, *reward*—to yourself. However, they can be very helpful when talking to people who only speak standard English, like a client you may be working with in the future or your parents whom you'll see over spring break. Sorry if this has been confusing, but that's what it is—confusing.

By the way, we haven't made formal definitions of positive and negative punishers, because they are not common enough to be on a BACB exam yet, but maybe by the 9th edition of *PoB*. Anyhow, by this point you could probably write your own bullet-pointed definitions of those two terms.

Definition: CONCEPT

Behavioral contingency

- The occasion for a response,*
- the response,
- and the outcome of that response.

* We'll be hitting on *the occasion for a response* in much more depth in Chapters 14 and 15 dealing with what we call *stimulus control*.

For example:

The occasion: The presence of Grandmother
The response: Grandfather makes a sensible remark
The outcome: A smile, a few kind words, and a caress from Grandmother

The occasion: As far as Ed was concerned, there was no specific occasion
The response: Ed moves his leg
The outcome: The shock is turned off

The occasion: As far as Velma was concerned, there was no specific occasion
The response: Velma grinds her teeth
The outcome: A cold ice cube on Velma's face

The occasion: The presence of Bruce Black
The response: Mark threatens
The outcome: Mark loses 50 points

QUESTION

1. *Behavioral contingency*—define it and give an example of each of the four basic behavioral contingencies, indicating the occasion, the response, and the outcome for each of those four contingencies.

Example of Extinction Behavioral Clinical Psychology

LUCILLE, THE RESTLESS RESIDENT[6] (B-9)

Lucille was a psychiatric resident in a hospital in Canada. She wandered from the ward for the psychiatric residents into the nurses' office. A nurse took her by the hand and led her back onto the ward. Lucille and the nurses repeated this ritual several times a day, day after day. Sometimes the nurses took her by the hand; other times, they just pushed her out of their office. But she kept returning.

Teodoro Ayllon was doing his doctoral internship there. He asked a nurse, "What's going on?"

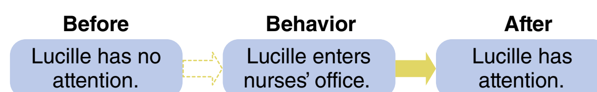
"That Lucille drives us crazy. She keeps coming into our office and pestering us. She's a real nuisance. We have to keep taking her back onto the ward," the nurse replied.

"Can't you just ask her to stop coming into your office and interfering with your work?"

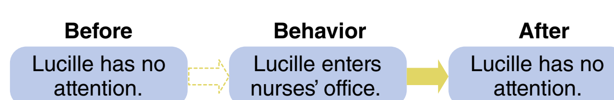
"We've tried that, we've tried scolding, we've tried everything; but she's too dumb to understand. She's mentally defective," the nurse said.

"Well, how long has this been going on?" Ted asked.

"At least for two years that I know of," the nurse said. Ted and his dissertation adviser, Dr. Jack Michael, thought the consequences of Lucille's entering the nurses' office might be controlling that response, like any other response. Put another way, some reinforcer must be maintaining it. In a problem of this sort, the first thing you should do is look at the events that follow the undesirable behavior. These events probably reinforce the behavior. Here, the undesirable behavior was Lucille's entering the nurses' office. And the event normally following involved removing her from the office, one way or another. But how could that be a reinforcer? In an abrupt way, the nurses were paying attention to Lucille.



Now, it might seem that this sort of attention could not act as a reinforcer, but it might be a powerful reinforcer because residents on the back wards of most psychiatric hospitals don't get that much attention from the nurses. Usually the best way to get attention in a psychiatric hospital is to act crazy. So, this aspect of life in a psychiatric hospital may help maintain the crazy behaviors. Suppose the attention involved in removing Lucille from the office reinforced her entering. Then they might get rid of this undesirable behavior by no longer giving her attention—by no longer removing her from the office when she entered. This could be true, though it seems strange that the best way to stop Lucille from coming into the office might be to no longer try to stop her. We call this stopping of reinforcement the extinction procedure.



You can imagine how reluctant the nurses were to try this extinction procedure, but they finally agreed. Each time Lucille entered the office during extinction, the nurses continued their activity as if she were not there. After a few minutes, Lucille would leave and the nurses would relax. Over the 8 weeks of extinction, the frequency of Lucille's entering the nurses' office gradually dropped from 16 times a day to only twice a day (Figure 2.3). Extinction worked!

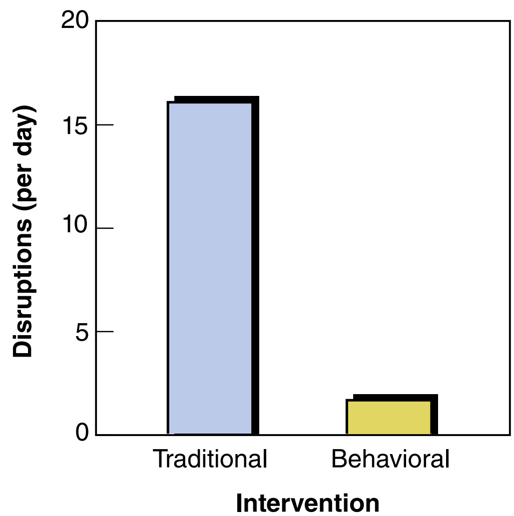


Figure 2.3 Using Extinction to Reduce a Psychiatric Resident's Disruptive Behavior

The traditional approaches failed to solve a problem for 2 years; yet the simple procedure of extinction solved the behavior problem in 8 weeks.

QUESTION

1. Describe the use of extinction to reduce disruptive behavior. Include:
   - the client
   - the reinforcer withheld
   - the results

Principle

EXTINCTION FOLLOWING REINFORCEMENT (B-9)

You've seen that reinforcement increases the frequency of a response. And you just saw that contingent attention increased the frequency of Lucille's entering the office. But now we want to decrease the frequency of the reinforced behavior. Also, as you've seen, we could decrease the frequency of behavior by using a positive or negative punishment procedure. But we can also do it another way. We can break the positive or negative reinforcement contingencies. We can stop the contingent presentation of reinforcers or stop the contingent removal of aversive conditions. With Lucille, the nurses stopped a positive reinforcement contingency; they no longer paid attention to her when she entered their office. As a result, they got rid of or *extinguished*, her uninvited visits.

Definition: PRINCIPLE

You run into extinction every day. For instance, you stop putting coins in a pop machine when it's empty. You stop writing with a pen once it runs out of ink. You stop calling your friend who never answers. You eventually stop trying to push down the clutch in your new car with the automatic transmission. If your horn goes out, you eventually stop fruitlessly pounding on the steering wheel when you get cut off. Extinction. Extinc . . . Ext . . . E . . .

Those Adorable Little Bullet Points

So the purpose of our little bullet points is to help you focus on the most crucial components of each concept:

Extinction

- ________ the positive or negative reinforcement contingency
- for a previously __________ response
- causes the response frequency to ________.

Extinction

- **Stopping** the positive or negative reinforcement contingency
- for a previously **reinforced** response
- causes the response frequency to **decrease.**

QUESTION

1. The *principle of extinction*
   a. Define it and
   b. Give an everyday example, maybe even from your own life!

History

LUCILLE, THE RESTLESS RESIDENT OR THE PSYCHIATRIC NURSE AS A BEHAVIORAL ENGINEER

In 1959, I was a grad student doing research with rats in Skinner boxes when Ted Ayllon and Jack Michael's article appeared. Wow! It blew me away. This was more or less the first time our years of research with rats and pigeons in Skinner boxes had actually been used to help human beings live better lives. Yeah, a few researchers had put human beings in human Skinner boxes, proving they'd press levers when the response was reinforced with candy or cigarettes, just like our beloved rats and pigeons; but that's not helping those people live better lives. Now you may not be too blown away by Ted and Jack's work, because you've already read a few studies showing how we can use our Skinner box knowledge to help people. But back then, no one knew as much about how we can use our Skinner box knowledge to help people. Already you know more than we did just from what you've learned from those first few studies, and certainly no one knew as much as you'll know about helping people with behavior analysis after just reading a few more chapters of this book. Back then, it was just us science guys with our rats and pigeons and Skinner boxes, wildly claiming that what we were doing was important, and generally being ignored (does that mean extinction doesn't always work?). In 2009, Jack told me that they had a heck of a time getting their article published in 1959 because the Skinner box scientists didn't think it met their high scientific standards; fortunately, common sense won out. It was published, and we were on the road to helping people live better lives with behavior analysis.

QUESTION

1. What was the historic significance of the Ayllon and Michael work with Lucille and friends?

Notes

1 Based on Williams, C. D. (1959). The elimination of tantrum behavior by extinction procedures. *Journal of Abnormal and Social Psychology, 59*(2), 269.

2 Based on Green, G. R., Linsk, N. L., & Pinkston, E. M. (1986). Modification of verbal behavior of the mentally impaired elderly by their spouses. *Journal of Applied Behavior Analysis, 19,* 329–336.

3 This section is based on Yealland, L. R. (1918). *Hysterical disorders of warfare*. London: Macmillan.

4 Based on Blount, R. L., Drabman, R. S., Wilson, N., & Stewart, D. (1982). Reducing severe diurnal bruxism in two profoundly retarded females. *Journal of Applied Behavior Analysis, 15,* 565–571. These behavior analysts were from West Virginia University, University of Mississippi Medical Center, and Millsaps College.

5 Based on Phillips, E. L. (1968). Achievement Place: Token reinforcement procedures in a home-style rehabilitation setting for "pre-delinquent" boys. *Journal of Applied Behavior Analysis, 1,* 213–223.

6 This case and the data shown are based on Ayllon, T., & Michael, J. (1959). The psychiatric nurse as a behavioral engineer. *Journal of the Experimental Analysis of Behavior, 2,* 323–334.

CHAPTER 3

Operant Conditioning for Dummies (Part II)

Behavior Analyst Certification Board 5th Edition Task List Items		
B-3.	Define and provide examples of respondent and operant conditioning.	Throughout
B-13.	Define and provide examples of rule-governed and contingency-shaped behavior.	Throughout
G-19.	Use contingency contracting.	Pages 37–39
G-20.	Use self-management strategies.	Pages 39–41

Getting a Little More Complex

SO WHAT THE H— IS BEHAVIOR ANALYSIS, ANYWAY?

We'll informally define it as:

The study of why we do, think, and feel what we do, think, and feel.

In other words, why we do what we do the way that we do it.

Based on a scientific study of these issues, experimental behavior analysis discovers scientific laws, the principles of behavior. And applied behavior analysts use those principles of behavior to help build a better world. (In Chapter 5, we'll get a lot deeper into all of this, including **behavior analysis**—the study of the principles of behavior.)

HOW QUICKLY SHOULD THE REINFORCER FOLLOW THE RESPONSE?—THE 60" RULE!

If the reinforcer is to reinforce a particular response, it must follow that response within about 60 seconds or less. We don't have experimental data on this for human beings, but the research with nonverbal animals suggests that a minute or two pushes the limit (even 30 seconds is hard[1]). And most behavior analysts working with nonverbal children agree. They'd quit their jobs if they had to wait 60 seconds before delivering each reinforcer to children. Such a delay is a good way to ensure that no learning will occur, even with people—at least not the intended learning. (By the way, when we say *we reinforced a response*, we mean *we gave a reinforcer soon after the response and that response occurred more frequently in the future*.)

So, if you're trying to reinforce a response, don't push that 60-second limit; push the 0-second limit. The direct, reinforcing effect of reinforcers drops off quickly as you increase the delay, even to 3 or 4 seconds. And even a 1-second delay may reinforce the wrong behavior. If you ask an active child to look at you and then give the reinforcer 1 second after that response, you're liable to reinforce looking in the opposite direction. So, one problem with delayed reinforcement is that it may reinforce the wrong response—the one that occurred just before the delivery of the reinforcer.

And that's very true in an intro rat lab course too. You want to shape Rudolph the Rat's lever-pressing behavior, so first you have to reinforce his looking at the lever, then moving toward the lever, then touching it, etc.; a reinforcer for each little bit of progress. But you've really got to be on top of your game and Rudolph's too. Like he just moved toward the lever, quick, quick, reinforce that response. But you're a half second too slow, Rudolph turns away from the lever, and you deliver the reinforcer. Uh-oh, you reinforced Rudolph's moving away from the lever, not moving toward it. It ain't easy when you're working with a fast-moving dude like Rudolph. But it's fun.

Roughly, a reinforcer must be delayed no longer than 1 second to be considered **immediate reinforcement,** and the closer to 0 seconds, the better; between 1 and about 60 seconds should be considered **delayed reinforcement**. If the reinforcer is delivered after 60 seconds, it probably won't reinforce the response and might just be called the pathetic **delayed delivery of a reinforcer**.

Yeah, but you do things where you get the reinforcer much later than 60"! Yes, we know; just hold on, we're going to get to that right now, in less than 60".

THE MYSTERY OF DELAYED REINFORCERS

Yes, you'll do something to get a delayed reinforcer, if you know whatcha do is gonna get that reinforcer. And that's the big deal. But what does *you know* mean? In this case, we think it means that you can describe the behavioral contingency. *If I read this chapter really carefully, underline, look over my underlines, and think about it, then 1 hour after I've done all that and go to class, I'll really rock it—the instructor and a few of the cooler students will really respect me, maybe even that cool gal or guy in the front row will pay attention to me*.

So, in this case, you've stated an if-then rule: *If I study hard, then I'll get respect. If I make a bunch of responses, then I'll get some reinforcers*—a behavioral contingency. The respect reinforcer is contingent on (dependent on, a result of) the study responses. It's a behavioral contingency involving reinforcers, but it's not a reinforcement contingency. The reinforcers are too delayed to directly reinforce the responses; remember our 60" rule. So the work-around is, if you know the rule describing the behavioral contingency, then that rule *might* control (govern) your behavior. And we call your behavior ***rule-governed behavior***. (Later on, we'll get into what kinds of rules can effectively control or govern your behavior and what rules probably can't.) And what will we call those behavioral contingencies that look like reinforcement contingencies but aren't, really, because the reinforcers are too delayed to reinforce? Let's call them ***rule-governed analogs to reinforcement contingencies*** or just ***analogs to reinforcement***. OK?

QUESTIONS

1. To get the best learning, how quickly should you give the reinforcer when reinforcing a response?
2. And roughly, what's the greatest delay you could have between the reinforcer and the response, to get any learning?
3. How immediate is immediate?
4. What's a good example of rule-governed behavior, and what behavioral concepts do and don't apply?

Rule-Governed Behavior and University Teaching

DR. SIDNEY J. FIELDS[2]

Once again, the alert observer would notice a tear trickle down Juke's cheek. Mae noticed. Juke was more moved seeing Sid walk across the stage to receive his PhD diploma than when he got his own MA diploma or when Mae got her PhD diploma.

The Problem

As BSU's most promising doctoral student in psychology, Sid had finished his coursework in record time, with straight *A*s. He'd also collected all the data for his doctoral dissertation. The only things left were to write a report of his dissertation and have his oral defense. So, the faculty of the Psych Department had unanimously voted to offer Sid a position as assistant professor. Of course, he'd finish his writing and have the oral defense of his dissertation during the summer, before he started teaching that fall.

But Sid didn't get his dissertation written that summer. In fact, he barely got started. And once the fall semester began, Sid hardly had time to look at his dissertation. No problem, he'd finish it during the next summer's break. But by the end of that next summer's break, the dissertation still remained uncompleted. The department chair warned Sid that if he didn't graduate by the next April, his contract as an assistant professor wouldn't be renewed. Sid felt like he was rapidly falling from the role of the department's favored son to the department's embarrassment. But he still wasn't making any progress.

What was his problem? Writing the dissertation was hard work, the hardest work Sid had ever done. But he *could* do it; that wasn't the problem. The problem was that he *didn't* do it. He did everything but write. He did more literature reviews in the library. He learned how to use new computer programs to improve his writing and make it go faster. He created a database of all his references. He cleaned the house—almost daily. He started a vegetable garden. But he didn't write. He meant to, and he definitely would—the next day, just after he got the house really clean. But the next day he planted the garden instead. And so on, with only an occasional lapse into the hard work of writing. Procrastination after procrastination until the summer was over. (Can any of you relate to poor Sid?)

The Solution (G-19)

Two months after the Psych Department chair had warned Sid that he was in danger of losing his job, Sid still hadn't written more than a few pages. So he went to his buddy Juke for help.

Juke: What you need is a **contingency contract**.

Sid: Huh?

Juke: It's the same sort of **contingency contracting** I use in most of the consulting I do with business and industry. You could do a contingency contract designed to get your butt in gear to write up your dissertation.

Sid: So in contingency contracting, I write down a list of tasks I'm going to do and give them to my contractor? Do you have time to be my contingency contractor?

Contingency Contracting Rule #1
Put it in writing.

Juke: I have neither the time nor the inclination to be your contingency contractor. But I don't know anyone else who could manage a hard case like you, so I'm it. You owe me one. I'll do it, but only if you're willing to put your rear end on the line. I've had it with trying to manage people's performance when we don't have effective behavioral contingencies we can add. You might select grades, credit, or money contingent on completing your contracts. What's your choice?

Sid: I really need to get this done. I'm desperate; so let's make two outcomes contingent on my completing each contract. I've signed up for dissertation credit, so how about having some of that turn into no credit if I blow off too much of my contract. Also, I'm willing to have some money riding on my performance. I'll deposit $200 with you, and you deduct some every time I screw up.

Juke: Let me make it heavier than that. Write 10 checks for $20 each, and make them out to the American Nazi Party. Then down in the memo section of each check write this: "Although I'm Jewish, I admire your work so much I wish to make this contribution." I'll mail one of those checks every time you screw up. Heh, heh.

Sid: Come on, Juke, give me a break.

Juke: No, man, and I'm not joking. I want to turn the heat on. I want you to know that each time you blow off a task, you're supporting the thing you hate most—the American Nazi Party.

Sid: OK, if you think that will really help.

Juke: Yes. And should I sweeten the pot by giving you back one of those checks each time you meet your contract?

Sid: No, making regular progress toward my graduation is sweet enough for me.

Contingency Contracting Rule #2
Have effective behavioral consequences.

Juke: OK, now we need to meet once a week, so you can show me your permanent products, evidence you've done everything you agreed to. And at the same time, you should show me your contingency contract for the next week—a list of tasks you're going to do and the time you're going to put in.

Sid: Do we really need to meet once a week? That's sort of a nuisance, isn't it?

Juke: Yeah, we really do. The weekly monitoring date is a deadline. That way you can't procrastinate more than a week on doing that week's tasks. The weekly deadline is our best procrastination preventer.

Contingency Contracting Rule #3
Performance not monitored once a week turns to Jell-O.*

Sid and Juke prepared the contract on page 66 for the first week, as shown in the table (note that a contingency contract is essentially a set of rules, and the performance it specifies is rule-governed behavior).

Juke: Here are the performance-management contingencies we probably should use: Any time you fail to do any item of your contract, I send out one of your checks. The second

* Actually Jell-O isn't the word we were thinking of, but this is a family book.

time, within a single semester when the total percentage of points you earn falls below 90%, two of your credits for your dissertation turn to no credit, and you'll have to sign up again and pay again for those credits. By the way, would you add to your contract for next week to get Dr. Harper's agreement on that credit-loss business?

Contingency Contracting Rule #4
Specify the contingencies clearly.

Sid: Also, I must analyze my data before my next contingency-contracting or performance-management meeting with you. And if I don't, I will lose the opportunity to earn two points; so my cumulative percentage of points earned lowers, and I move a little closer to losing 2 credit hours.

Juke: Yes, if you don't analyze your data before our meeting for that week, you'll lose two points.

Contingency Contract

Contractee: Sid
Contingency Contractor: Juke

Tasks	Proof	Hours		Points	
		Do	Done	Pos.	Earn
Write 8 hours on introduction.	4 new pages	8		8	
Meet with Dr. Harper to review writing progress (every 2 weeks).	notes from meeting	1		1	
Analyze data.	2 graphs	2		2	
Graph points earned (cumulative and noncumulative).	updated graphs	0.1		1	
Prepare contract for next week (before meeting with Juke).	contract	0.2		1	
Meet with Juke.	obvious	1		1	
Totals		12.3		14	

And now, it's about time we formally define the concept of the all-powerful contingency contract, as well as a couple more fundamental concepts:

Definition: CONCEPT

Rule

- A description of a behavioral contingency.

Rule-governed behavior

- Behavior under the control of a rule.

Contingency-shaped behavior

- Behavior under the control of a direct-acting contingency.

Contingency contract (behavioral contract or performance contract)*

- A rule statement describing
- the desired or undesired behavior,
- the occasion when the behavior should or should not occur, and
- the added outcome for that behavior.

There's a big difference between contingency-shaped behavior and rule-governed behavior. Contingency-shaped (contingency-controlled) behavior is behavior that's reinforced or punished by a direct-acting contingency, one where the consequence of the response occurs within 60" of that response. Rudolph the Rat presses the lever and immediately gets a food pellet. While watching Netflix, without realizing it, you reach into the bowl and immediately get a handful of M&Ms. For both Rudolph and

* I've always used the terms *performance contract* or *behavior contract*, but when I saw that the official term now was *contingency contract*, I Googled it and was shocked to read that *contingency contract* is most often used in business to specify a business contract, where, if your house burns down, you'll get $100K, so the $100K is contingent on your house burning down. Also, if your band is scheduled to play tonight, but you cop out because you've got a hangover, the contingency contract specifies that you'll have to pay the club owner $100K. (By the way, it would probably not be a good idea to burn down your house to cover the expenses of paying the club owner.) And *behavior contract* is often used in K through 12 schools, where *behavior* usually means bad behavior occurring too frequently or good behavior occurring too infrequently. And the *behavior contract* just specifies the rule that describes the consequences that are contingent on good or bad behavior.

you, the response is directly reinforced, without a rule. We're talking **contingency-shaped behavior**.

You ask, "Honey, where'd you put that extra bag of M&Ms?" And against her/his better judgment she/he tells you. Now you have a rule: "If you go to the upper left-hand shelf, you can find the bag of M&Ms." And if you follow that rule, we've got **rule-governed behavior**. But that won't work with poor Rudolph. We can only use direct-acting contingencies to shape his behavior, but Honey can govern all sorts of your behavior with rules—at least she/he can try.

And a contingency contract describes a contingency, usually a rule-governed analog to a direct-acting reinforcement or punishment contingency. And if the contract is successful, then the contractee is performing rule-governed behavior. Honey says, "If you clean up this mess you've made, I'll give you a bowl of M&Ms." You do it, and we're talking **rule-governed behavior**.

The Results

It wasn't easy. Even with his contingency contract, Sid still had to fight that procrastination devil, and he was already working more than full time with his teaching job. During the rest of the academic year, he lost a total of $160 and two academic credits. And his cumulative average of points earned (roughly the same as tasks completed) was 88%. He averaged about 13 hours per week working on his dissertation, and during the 3 weeks before he had to turn his dissertation into the graduate college, he averaged 35 hours per week.

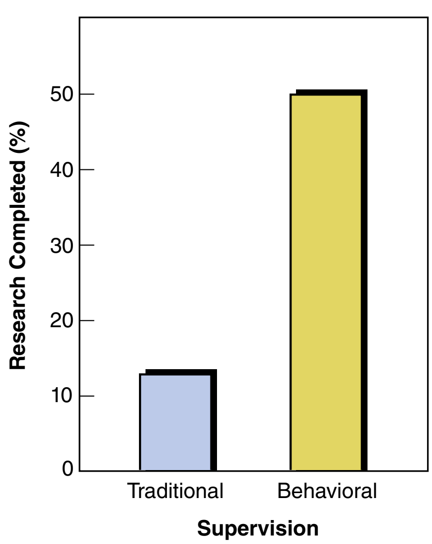


Figure 3.1 Completion of Projects, Theses, and Dissertations

But he got it done: He passed the oral defense over his dissertation, he got his teaching contract renewed, and he got his dissertation accepted for publication. He is now Dr. Sidney J. Fields, PhD, a man who is no slouch in the field of behavior analysis.

Figure 3.1 shows that a contingency contract can really help students.[3]

QUESTIONS

1. *Rule*—define it and give an example.
2. *Rule-governed behavior*—define it and give an example.
3. *Contingency-shaped behavior*—define it and give an example.
4. Describe the use of the contingency contracting. List and illustrate the four rules of contingency contracting.
5. *Contingency contract*—define it and give an example (it need not include more than one behavior).

Self-Management: Using Applied Behavior Analysis to Get Your Act Together (G-20)

We saw how Juke and Sid used a contingency contract to help Sid get it together. Well, you can do the same thing. You can use a contingency contract to do your own self-management, to help you accomplish some of your own goals, like studying more, getting better grades, and incidentally learning more. Or you could do some of that exercise you used to do when you were in high school, exercise that seems to be falling through the cracks now. Or if you're a junior or senior when you read this, you may notice that you've put on a few pounds in the last two or three years; you're not nearly as trim as you were when you graduated from high school. So, you can do self-management with a contingency contract to help you get your pigging out under control, because if you don't get on top of it now, it'll get on top of you. Unfortunately, I see this happening all the time, like you won't look nearly as wonderful in that wedding dress as you would have at the time you graduated from high school. (And my point isn't to encourage students to get married as soon as they graduate from high school.)

Here are some self-management (performance-management) projects students like you have worked on:

One of the most moving: A student had a dying friend living in another town. She wanted to stay in touch with her friend and give her support; she wanted to write a weekly letter to her friend, but often didn't get around to it (it's hard to do). But as a result of using self-management, she reliably gave her friend love and support every week for the rest of her life.

Saving those pearly whites: You probably know you're a dumbass if you don't floss every day, but you'd probably do well to floss once or twice a week. Use self-management to get on it.

Exercise: Remember, the way to Hell is paved with closets full of unworn Adidas running shoes. In addition to working on running and weight training, students have also worked on kickboxing, biking, and yoga.

General quality of life: Peter listened to stress-reducing music 30 minutes per day. Jeff read a chapter of Tom Clancy's *Without Remorse* five days/week. Dan practiced his guitar 1/2 hour per day by 11 P.M. Andrea ate one serving of a high omega-3 food every day. A few have done house cleaning or making the bed. Some students read the Bible for 1/2 hour/day, and maybe with 5 minutes of rumination afterwards. (One of those students had been an international evangelist.) Another student spent some time each day making sure her hair and makeup were cool, and a different student's goal was to wash her face before going to bed. One studied German 1/2 hour/day, 5 days/week, not for a course but just to get better at German. And I really love this one: Heather got up at 6 A.M. every school day so she could spend a half hour of quality time with her son every morning before she put him on the school bus (she said that her little boy and she really loved it). More: daily journaling and getting out of bed before the third alarm.

Academics: Many increased their overall number of study hours/week. Dana worked specifically on her physiological psychology course, which she'd had trouble with. Gretchen studied in the library for her Graduate Record Exam, 2 hours/day, 5 days/week.

Behavior they reduced: Melanie worked on her "potty mouth." Amy paid $5 for each day she ate more than 2,500 calories. Jason paid a penalty of $1 per cigarette. Ann paid $3 per cigarette. Others worked on chewing the end of an ink pen, nail biting (very popular), more than one cappuccino/day, no more alcohol (beer), apologizing too often (very common among women; the opposite problem for men), late for appointments, skipped classes, doing dope, staying up beyond midnight (no good happens after midnight).

Negative punishment (penalty) for dropping the ball: Most lost money, but one didn't get her evening ice cream if she failed her daily contract. And to make it even more aversive, another had to pay her ex-boyfriend $5. Don't eat when not hungry or else no Netflix for the next day. (My professional opinion is that penalty is too extreme!)

Positive punishment: Tom twirled his wedding ring on his fingertips, lost it, and had to buy a new one, so he used rubber-band therapy (You wear a loose rubber band around your wrist and flip it as a little positive punishment. Yeah, it can sting, but it can really decrease your tendency to do the bad behavior!). If Jess failed, she'd have to pick up dog poop, which her husband usually did. Call Grandma weekly, or Mom would pick something for her to clean. (Grandma didn't know.) Make the bed or feed the pigs. And my students' latest favorite positive punishment: Drink a couple tablespoons of apple cider vinegar in front of the class!

True confessions: I could go on for twice this long about my own efforts using behavioral self-management to get my act together over the last 40 years, but let me just say that right now it's Christmas vacation, and I barely got last year's taxes to my accountant, so he could zip them to the Feds before New Year's Eve. Pretty cool, huh? And I had the illusion that I could spend most of vacation working on the 8th edition of *PoB* (*Principles of Behavior*), but as the end of vacation is only a week away, I've implemented a special contingency contract: 6 hours of writing/day or $20/missing hour to my lab so the grad students can buy the high-sugar, high-fat snacks they love and that I am now too pure to eat. But, if you really get into this self-management stuff, you might check out *I'll Stop Procrastinating When I Get Around to It* and the world's best and also only behavior-analytic comic book, *Contingency Management in Education & Other Equally Exciting Places*.[4]

Your Very Own Research Project

A few of your behavior-analysis teachers said they like to have you guys start lab experiments or research projects at the beginning of this course. So that's why, with *PoB* 8e, we've added the animal lab (Chapter 2) and self-management hype (Chapter 3). Just trying to get you a little turned on. Unfortunately, most of your teachers won't be able to offer you an animal lab, and many of them won't be inclined to get you going on a research project, like a self-management project. And that makes sense, because they're busting their butts staying on top of your lectures, homework, quizzes, etc. You think it's a lot of work for you; pity your poor teachers. But . . . you might tactfully ask your teacher if you could do your own project, maybe for extra credit in this course. Probably not; I don't give extra credit either. So, here's another possibility, though an even slimmer one: You could very, very tactfully ask your teacher if you could do it for an extra 1 hour of academic credit, which, of course, you'd pay your university for. That probably won't work, so then you might very subtly let a tear or two trickle down your cheek. Can you imagine what it would be like if your whole class started crying? Just don't mention where you got the idea.

QUESTIONS

1. Give two or three examples of self-management projects students have done.
2. And while you're at it, give an example of one you'd like to do, or at least should do, even if you wouldn't like to do it.

Self-Management

OK, we've been talking about *self-management*, so you know we're going to define it:

Definition: CONCEPT

Self-management

- The use of a contingency contract
- where the person whose behavior is being managed
- determines/performs one or more components of that contract.

Here are the six major components of a self-management or any contingency contracting:

- selecting the desired or undesired behavior
- selecting the occasion when the behavior should or should not occur
- modifying the environment to increase the likelihood that those goals can be reached
- monitoring/recording that behavior
- selecting the added outcome for that behavior
- presenting that outcome

But let's not get too hung up on how many components the person must have a hand in before we can say they're *self-managing* or only *semi-self-managing*. For example, I often need someone looking over my shoulder to make sure I'm not cheating too much on my own self-management contracts.

QUESTIONS

1. *Self-management*—define it.
2. What are the six major components of a self-management contingency contract?

SELF-MANAGEMENT IN THE CLASSROOM

Many behavior analysts are working with special ed and regular ed kids, K through 12, helping them increase their studying and decrease their problem behavior, using one or more of those self-management components. For example, our Mark had not only been having problems in the school shop, but he was also having problems in his history class—he wasn't studying. Now the Rosa Parks Academy was much smaller than the school you went to, so Bruce Black not only taught shop, but he also taught history. However, Bruce had now become such a fan of Mae's contingency contracting that he eagerly rushed to her for help. (Yeah, we didn't tell you at the time, but punishment contingencies, like the negative punishment contingency they used in the school shop, can also be the driving force within a contingency contract.)

Although Bruce had talked to Mark a couple times, explaining what his study behavior should be and how important it was—nothing. So, with Mae's guidance, Bruce encouraged Mark to do a little self-management, to make a "+" sign on a special sheet of paper every time he noticed that he was actually studying, during history class, and a "–" sign every time he noticed that he wasn't. In other words, Mark would be **monitoring/recording his own behavior**. Not bad, if it works, and it did! Mark's studying immediately jumped from a pathetic 30% to 78% and eventually to a heroic 88%. Wow! Sometimes a little self-awareness goes a long way. Maybe we should all try this **monitoring/recording our own behavior**? Whaddya think?[5]

QUESTION

1. Please give an example of self-management in the classroom.

OPERANT CONDITIONING (B-3)

Wow! We got so excited about your research projects, we almost forgot about the title of this chapter, *Operant Conditioning*. So what is it? It's what you've been reading about. It's how the results of what you do affect how often you'll do it next time around, how the consequences affect the future frequency of your behavior, how reinforcement and punishment affect us all.

Definition: PRINCIPLE

Operant conditioning

- Reinforcing or punishing consequences
- immediately following a response
- increase or decrease its future frequency.

So the title of these two chapters is *Operant Conditioning for Dummies*, but you know we're just kidding, right? You ain't no dummy. And by the time you finish this course you'll actually be an operant-conditioning smarty. But now, take a little breather and we'll see you in the next chapter . . . unless you want to review it for the quiz you'll have in 15 minutes. (Tech Talk: Another term for ***operant conditioning*** is *instrumental conditioning*. And similarly, you can also say *instrumental behavior* rather than *operant behavior*. Damn, I almost forgot; the everyday term we all know and love is simply *learning*. Yeah, that's what we're talking about—how you learn. But we scientists must have our technical terminology, so instead of talking about *operant learning*, we insist on talking about *operant conditioning*. I know how you feel, but live with it.)

And we also talk about ***operant behavior***, like Skinner's rat pressing the lever, Sid's writing his dissertation, your exercising, my flossing my teeth—you've got the picture.

Definition: CONCEPT

Operant behavior

- Behavior that operates on the environment
- and is influenced by its reinforcing or punishing consequences.

And we distinguish between operant and respondent behavior, like salivation, pupal contraction, and blushing. Presumably, the principle of operant conditioning doesn't apply to respondent behavior, and the principle of respondent conditioning doesn't apply to operant behavior. (But don't tell your professor: I personally think all behavior is operant behavior, that even Pavlov's dog's salivation can be reinforced and punished; however, that's my minority position.)

Also, a couple days ago, a Facebook friend messaged me a humorous photo about demanding that customers wear their coronavirus masks. Then she commented, *When I see this, I remember you: Trained dog touching bell, to get food*. Unfortunately, she hadn't read our first three chapters, or she wouldn't have gotten Pavlov and Skinner so mixed up. But I replied with a couple *hilarious laughing* emojis anyway.

QUESTION

1. Define and give an example of

   a. *Operant conditioning*
   b. *Operant behavior*

Principle

THE LAW OF EFFECT

Edward Thorndike (1874–1949) did the classic experiment that involved his puzzle boxes. A puzzle box is a cage containing dangling ropes, levers, and latches that a cat (or another organism) can manipulate. If the cat makes the proper responses with those manipulanda, the cage door would unlock; and the cat could exit. Thorndike locked the cat in the puzzle box and placed food outside the box, just out of the cat's reach. At first, the cat would spend a lot of time approaching the food but, of course, could not get it. However, soon the cat would happen to bump into the lever that unlocked the door; then the cat would get the food. After about 3 minutes of trials, it would quickly press the lever, exit the cage, and get the food reinforcer. So the cat decreased its unreinforced behavior and increased its speed of pressing the lever, exiting the cage, and getting the food reinforcer. Thorndike called this *trial-and-error behavior*. He concluded that cats do not learn by developing insight into a problem; instead, they learn through trial and error. In contemporary terms, if they happened to make a response that happened to produce a reinforcer, they would make that response more quickly the next time. He also believed this is how human beings learn.

Thorndike's ***law of effect*** simply states that *responses made just prior to "pleasant" events are more likely to be repeated, while responses made just prior to "unpleasant" events are more likely to diminish*. He called these "pleasant" events *satisfiers* and the "unpleasant" events *annoyers*.

We think the law of effect is the most important law in psychology. And, in our view, the law of effect forms the basis of behavior analysis, and behavior analysis forms the basis of most worthwhile psychology. The law of effect is the most powerful tool available for understanding human behavior.[6] However, psychologists criticized the original law of effect for being either circular* or involving subjective terms (*pleasant* and *unpleasant*). So here's a modern version that eliminates both circularity and subjectivity:

Definition: PRINCIPLE

Law of effect

- The effects of our actions
- determine whether we will repeat them.

Here, *effect* means *results* or *outcomes*. So we could say *the law of **results** says the **results** of our actions determine whether we will repeat them*.

It's so simple! Right? It's just a summary of our four basic contingencies of reinforcement and punishment. If our actions produce reinforcers or reduce aversive conditions, we tend to repeat those actions. And if our actions produce aversive conditions or remove reinforcers, we tend to stop repeating those actions. So simple—and yet so powerful. It summarizes everything you've read so far, and everything you'll read in the rest of this book. It summarizes life! That means that if you understand how the law of effect works, you understand the prime mover of our lives. And you'll have a fighting chance to do something about it.

Question

She winks at him as he enters the classroom. He smiles. The next time he enters the classroom, he smiles, before she has a chance to wink. Is this an example of the *law of effect*?

Our Answer

The action we're analyzing is his smiling. The effect or result of his action is not her wink, because the wink occurs before the smile. So even if he does repeat the smile, it's not because of the effect of that action. The example says nothing about its effect or results, so the law of effect doesn't apply.

* We'll hit on *circular reasoning* in Chapter 5.

Question

He normally ignores her, but this time she winks at him as he enters the classroom. He sits down next to her and begins to chat. Now she will more frequently wink at him when he enters, and he usually sits next to her on those occasions. *Law of effect?*

Our Answer

Without a doubt. The effect, or result, of her wink was the reinforcer of attention. So her winking eye is becoming muscle-bound because of its frequent use.

QUESTION

1. State the law of effect and comment on its value.

Warning

TALKIN' TO MOMMY AND DADDY

OK, so you just learned some really cool behavior-analysis terms, and you're gonna learn a lot more cool behavior-analysis terms in this course, but don't forget to talk normal English when you go home to tell Mommy and Daddy about all the cool stuff you're learning in your behavior analysis course. They won't understand what the heck you're saying and will just think you've become a pompous little brat. So say **reward**, not **positive reinforcer**. And maybe **unpleasant**, not **negative reinforcer** or **aversive stimulus**. **Escape**, not **negative reinforcement**. **Penalty**, not **negative punishment**. **Punishment**, not **positive punishment**. For **extinction**, you're on your own on that one. Maybe **learning**, not **operant conditioning**. And I'm not kidding; this has become such a serious problem that the Behavior Analysis Certification Board is requiring that you relearn English, so you can talk understandably to your clients and their mommies and daddies.**

Notes

1 Lattal, K. A., & Gleeson, S. (1990). Response acquisition with delayed reinforcement. *Journal of Experimental Psychology: Animal Behavior Processes*, *16*, 27–39.

** The BACB may not care about how well you get along with your own mommies and daddies, but Kelly and I care, whether or not they're helping with your tuition.

2 Sid Fields is a fictional character. Resemblance to any people living or who wish they were dead is purely a result of the ineffective contingencies in the lives of so many ABDs (All But Dissertations). The data reported for Sid are a fictionalized composite of the typical case. The graphed data are real. This section is based on Dillon, M. J., & Malott, R. W. (1981). Supervising master's theses and doctoral dissertations. *Teaching of Psychology, 8*, 195–202; and Garcia, M. E., Malott, R. W., & Brethower, D. (1988). A system of thesis and dissertation supervision: Helping graduate students succeed. *Teaching of Psychology, 15*, 186–191. (The relevant data in this chapter are from this article.)

3 These data are from Garcia et al. (1988). They represent the percentage of projects, theses, and dissertations completed during the Garcia study; of course, more were completed after the end of the study.

4 Malott, R. W., & Harrison, H. (2005). *I'll stop procrastinating when I get around to it*. Kalamazoo, MI: Behaviordelia; Malott, R. W. (1971). *Contingency management in education & other equally exciting places*. Kalamazoo, MI: Behaviordelia.

5 Based on Broden, Hall, and Mitts (1971), as described in Cooper, J. O., Heron, T. E., & Heward, W. L. (2020). *Applied behavior analysis* (3rd ed., pp. 591–593). Hoboken, NJ: Pearson Education.

6 Thorndike, the law of effect, and eugenics. I'm impressed by the irony that the guy who laid the foundations of behavior analysis was a eugenics-loving racist, sexist, and anti-Semite, an outspoken advocate of biological determinism, whereas his law of effect inspired the development of behavior analysis, a strong science of environmental determinism, the opposite of eugenics-loving racism, sexism, and anti-Semitism. Wikipedia him @ https://en.wikipedia.org/wiki/Edward_Thorndike#Eugenic_views. And check out Columbia University's plans for Thorndike Hall @ www.tc.columbia.edu/articles/2020/july/important-announcement-from-the-president-chair-of-the-board-of-trustees/.

PART III

Methodology and Philosophy

CHAPTER 4

Research Methods

Behavior Analyst Certification Board 5th Edition Task List Items		
A-1.	Identify the goals of behavior analysis as a science (i.e., description, prediction, control).	Pages 62–64
C-1.	Establish operational definitions of behavior.	Pages 52–53
C-8.	Evaluate the validity and reliability of measurement procedures.	Pages 52–53
D-1.	Distinguish between dependent and independent variables.	Page 47
D-2.	Distinguish between internal and external validity.	Pages 61–62
D-3.	Identify the defining features of single-subject experimental designs (e.g., individuals serve as their own controls, repeated measures, prediction, verification, replication).	Page 54 and throughout
D-4.	Describe the advantages of single-subject experimental designs compared to group designs.	Pages 53–54, 59
D-5.	Use single-subject experimental designs (e.g., reversal, multiple baseline, multielement, changing criterion).	Pages 50, 57–59
D-6.	Describe rationales for conducting comparative, component, and parametric analyses.	Pages 59–60
E-9.	Behavior analysts and research.	Pages 56–57
G-19.	Use contingency contracting.	Page 58
H-3.	Recommend intervention goals and strategies based on such factors as client preferences, supporting environments, risks, constraints, and social validity.	Pages 55–56

In this chapter, we'll give you our answers to two questions: Why should we do behavior analysis? How should we evaluate behavior analysis?

Why Should We Do Behavior Analysis?

TO UNDERSTAND THE WORLD

In this book, we'll emphasize the practical side of the science of behavior analysis—we'll stress its contributions to improving life in the universe. We'll do this for several reasons: That's the ultimate purpose of most of the science and technology of behavior analysis; that's the easiest to understand; and that's what students are initially most interested in. In fact, this is our slogan:

Save the world with behavior analysis.*

But there's also a theoretical side. There's also the notion that science, including behavior analysis, is of value in its own right. More precisely, there's the notion that our scientific understanding of people, the world, and the universe is of value regardless of whether it helps us save the world. According to this view, science, including behavior analysis, is like art and music. Even if it doesn't contribute much to saving the world, it makes the world a better place to live in and thus

* For the pedantically challenged, we say *working toward the well-being of humanity*, rather than *save the world with behavior analysis*. The sophomorically pedant say behavior analysis can't save the world, because we don't know enough; and besides, you need biology, physics, political science, and so on; and besides, who's to say what a saved world is? I say, give me a break, have a life; it's just a rough guideline, a political, religious, philosophical slogan, a joke—go with cynical idealism. But even so, we're still serious about it.

a world more worth saving. Just as we have art for art's sake, so we have scientific knowledge for knowledge's sake.

We also advocate the value of pure knowledge. One of the things we like most about behavior analysis is that it gives us insights and understanding concerning the behavior (the psychological nature) of human beings and of our cousins in the animal kingdom. So we have another slogan:

Understand the world with behavior analysis.

We should do behavior analysis for two reasons: to **save** the world and to **understand** the world.

TO BUILD A BETTER WORLD

We said the goal of humanity should be the well-being of life in the universe. **The well-being of the universe should also be the goal of behavior analysis**, as it should for every profession. So we should concentrate on designing systems that make people happy, healthy, and productive—that maximize human potential for contributing to the well-being of the universe.

We are behavior-change professionals; we analyze and deal with problems that might affect a person, group, community, ecosystem, or future generations. We ought to understand behavior and what maintains it. We ought to change behaviors that harm the universe. We ought to maintain behaviors that help the universe. We ought to use our profession to build a better world.

We don't have to look too hard to find areas where behavior analysts could make a difference. Just think close to home for a minute: your parents, your spouse, your children, your friends, your boss, your dog, yourself. Can you see anything wrong there? Can you find anything worth improving?

Would you work to improve the quality of life—physical health, psychological well-being? Would you add quality years to people's lives by helping them follow healthy diets and exercise programs? Would you reduce hassles between people—between mothers and daughters, between brothers and sisters, between husbands and wives, between workers and employers, between government and citizens, between colleagues, between friends? (We even have hassles within single people; many of us hassle ourselves more than we do anyone else.) Would you contribute to a better environment by getting rid of water and air pollution? Would you reduce conflicts between countries? Would you prevent starvation, illness, and wars (both nuclear and conventional)? Behavior analysts have developed and tested an effective behavioral change technology; that's what this book is all about. Now it's time to continue with the extension and testing of this technology in these broader areas we've just mentioned. So one way to build a better world is to use behavior analysis as one of the building tools.

QUESTION

1. What are the two main goals or values of science, including behavior analysis?

How Should We Evaluate Behavior Analysis?

INDEPENDENT VARIABLE AND DEPENDENT VARIABLE (D-1)

A Little Warm-Up

So to understand our world, we behavior analysts do **research**. We want to find out what causes what, what's the **cause** and what's the **effect**, what's the cause and what's the **result**, what's the **independent variable** and what's the **dependent variable**. And we usually do **experiments** to answer those questions. So Skinner put Rudolph in the Skinner box, along with a food-reinforcement contingency, and he discovered that this positive reinforcement contingency increased Rudolph's lever-press frequency. The reinforcement contingency was the cause, and the lever-press frequency was the effect, the result. The frequency was the **dependent variable**, because it was dependent on what the experimenter, Skinner, did. And Skinner was independent to do various things, but what he did was use the reinforcement contingency, the **independent variable**.

What about Juke's grandfather? The frequency of his spontaneous remarks was the dependent variable, and the contingent, reinforcing smiles he received were the independent variable, the cause Juke and his grandmother used to increase the dependent variable, his smiles. Skinner and Rudolph are an example of basic research, the **experimental analysis of behavior**, done to increase our understanding of the world. Juke and his grandfather are an example of **applied behavior analysis**, done to build a better world, one grandfather at a time.

And remember Ed, the vet with the paralyzed leg? Yealland's independent variable, the negative reinforcement contingency with the electric shock, increased the dependent variable, the magnitude of Ed's leg movement until it was functional and moving completely normally—applied behavior analysis.

And the bruxism cases? What was the ice cube punishment contingency (___________ variable), and what was the frequency of tooth grinding (_________ variable)?

In the school shop, Mark's frequency of threats was the (_________ variable), and Mae's point-loss penalty contingency (_________ variable)?

The Details

The concepts of ***cause*** and ***effect*** are complex, and not all philosophers of science value them. But at least they're a place to start. You turn on your kitchen stove, and the water starts to boil. Roughly speaking, the heat from the stove caused the water to boil. The heat was the cause. The boiling was the effect.

Each time Rudolph presses the lever, you give him a drop of water—you reinforce the lever presses. In the future, Rudy presses the lever more frequently. Your positive reinforcement caused his increased frequency of lever pressing. Past reinforcement is the cause; the increased frequency of pressing is the effect. Cause and effect.

And that's what scientists study—cause and effect. The scientist asks, why does something happen? What causes it? I wonder what the effect would be doing this or that. Cause and effect.

(Tech Talk: But scientists don't often say *cause* and *effect*. Instead, they say ***independent variable*** and ***dependent variable***. You might say a particular value [amount] of the independent variable causes a particular value [amount] of the dependent variable.)

You might say a particular temperature of the water causes it to boil at a particular rate. The temperature is the independent variable, and the rate of boiling is the dependent variable. And you might say a particular amount of reinforcer causes Rudolph to press the lever at a particular frequency. The amount of reinforcer is the independent variable, and the frequency of pressing is the dependent variable.

So, two basic concepts of science are dependent and independent variables. In behavior analysis, the *dependent variable* is a measure of the person's or participant's (subject's)* behavior. The *independent variable* is the variable the behavior analyst or experimenter systematically changes to influence the dependent variable.

Now here's one that's a little tricky. Remember Lucille, the restless psychiatric resident who kept wandering into the nurses' office?

What's the dependent variable? __________________________

And the independent variable? __________________________

You might say the independent variable is the nurses' attention, and that's close, but can you get a little closer? It was their attention **contingent** on her entering their office. If she'd gotten a lot of attention no matter where she went, that wouldn't have caused her to keep wandering into their office. And what procedure did Ayllon and Michael use to decrease her wandering into the office? Extinction. Rather than increasing the amount of the independent variable, they decreased it to zero; they decreased to zero the amount of reinforcement that was contingent on her wandering into the office. Often we increase the value or amount of the independent variable, but sometimes we decrease it, as in this case.

Definition: CONCEPT

Independent variable

- The variable the experimenter systematically manipulates
- to influence the dependent variable.

Definition: CONCEPT

Dependent variable

- A measure of the participant's** behavior.

* For the previous hundred years, scientists used ***subjects*** to refer to the people or animals they were studying in their research. However, in the last 20 years many, but not all, have become uncomfortable with *subjects*, as that implies a passive obedience, a subjugation to the emperor. *Subjects* has a sort of disrespectful, condescending feel. So now, ***participants*** is preferred by many, including us. Therefore, in the 8th edition of this book, we've started to replace *subjects* with *participants*, at least when we're talking about people. But so far, no one has suggested we should replace *single-subject* research design with *single-participant* research design—so far; and we'll go with the BACB and stick with ***single-subject research design***. Oh yes, as you'll see, dancing back and forth between *subject* and *participant* does get a little awkward; but we're trying.

** Scientist Talk: And scientist will say the *dependent variable* is the *subject's* behavior. Everyone Else's Talk: Practitioners will say "we want to improve the *person's*, *client's*, *child's behavior*" and not

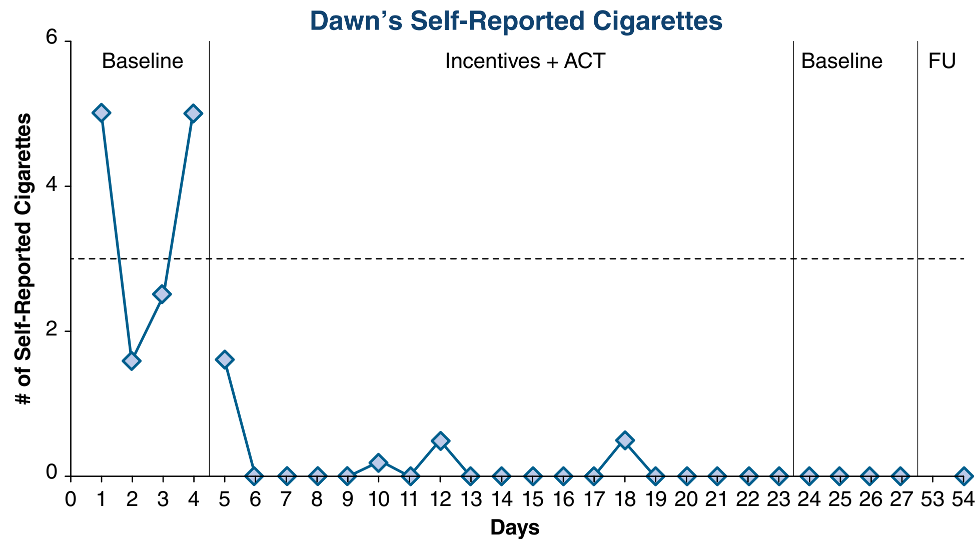


Figure 4.1 Cigarettes Smoked

QUESTIONS

1. Define each of the following concepts:
   a. *dependent variable*
   b. *independent variable*
2. Describe an experiment that illustrates these two concepts.

Example

HOW TO STOP SMOKING[1]

Back Before Rod

Dawn: I keep giving parents professional advice about how to raise their kids. So, I think it's about time we have our own kid!

Sid: Ah . . . yeah . . . right. . . .

Dawn: And we know so much about behavior analysis; so we'd raise a super-kid!

Sid: Ah . . . yeah . . . right. . . .

Dawn: The only problem is . . . I need to stop smoking.

Sid: Absolutely, let's help you stop smoking! . . . So we can have a . . . kid. Smoking is the leading cause of preventable death in these great United States. Like 35.5 million adults smoke here!

Dawn: Thank you, Mr. Google Brain.

Sid: And I've got an idea!

Dawn: I'm sure you do.

Sid: Another grad student at BSU has a grant to do his dissertation on using behavior analysis to promote smoking cessation. You could be a subject, I mean participant, in his research.

So, five days a week, Dawn went to BSU to tell the experimenter how many cigarettes she'd smoked the previous day and to have her breath analyzed for carbon monoxide (on Monday she also reported her previous two days' smoking). If the carbon monoxide analysis showed no signs of smoking, she got a money reinforcer that increased by $5 every day she was clean, like $5, $10, $15, etc. Her results are shown in Figures 4.1. and 4.2.

What's the dependent variable? Actually, there are two of them. Number of self-reported cigarettes per day (Figure 4.1: vertical axis, *y*-axis, **ordinate**) and carbon monoxide readings (Figure 4.2: *y*-axis, **ordinate**). And the independent variable? The number of days using the performance management contingency involving the money reinforcers (horizontal axis, *x*-axis, **abscissa**). If Dawn's carbon monoxide level went above 3, the dashed line, that indicated she'd been smoking during the previous 24 hours, and she wouldn't get the reinforcer, the dollars, for that day.

By the way, we scientists usually record the value of the dependent variable on the *y*-axis and the value of the

"to improve their *dependent variable*." And when they get excited, even scientists will say, "Did you see the cool stuff Rudi did?" not, "Did you see the *subject's* cool *dependent variable*?"

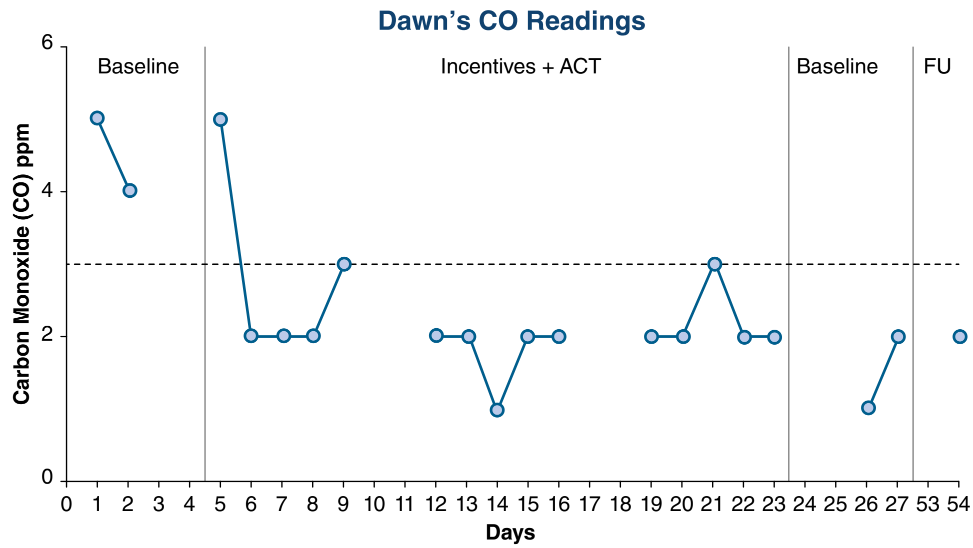


Figure 4.2 Carbon Monoxide Readings

independent variable on the *x*-axis. In other words, the value of *y* is a function of (caused by) the value of *x*.*

Baseline

The first phase of this experiment is called the ***baseline***; this is a period when the independent variable isn't being used, no dollar reinforcers. During baseline, Dawn reported that she'd been smoking and her carbon monoxide levels confirmed it. Then on day 5, she started getting the dollar reinforcers when she hadn't smoked. And her rate of self-reported smokes went way down, as did her carbon monoxide levels.

Definition: CONCEPT

Baseline

- The phase of an experiment or intervention
- where the behavior is measured
- in the absence of an intervention.

Then on days 24–27, they returned to baseline, no dollar reinforcers, and Dawn stayed pure, no smoking. So maybe she no longer needed the dollar contingency? The vertical line between days 27 and 53 indicates that they stopped collecting data during that time. But Dawn returned for a follow-up on day 54, and she was still clean. Cool.

* Yeah, we know; Sid, "the scientist," didn't manipulate the days—the days roll on, one day at a time, without any help from scientist Sid. But what Sid did manipulate was the days for which Dawn would get her money reinforcer, if she hadn't smoked.

QUESTION

1. *Baseline*—please define it and give an example.

Concept

MULTIPLE-BASELINE DESIGNS (D-5)

Sid: OK, gang, you're graduating this semester, and you'll be looking for either a grad school or a job. And a few of you've told me you're a little nervous about this, even though you're good students, and even though those of you who have been training to become Registered Behavior Technicians or Board Certified Assistant Behavior Analysts will have more job offers than you can handle. What you seem to be most nervous about are the interviews. So, I'd like to help you out and do a little applied behavior analysis research at the same time. I'd like to replicate** an interesting experiment[2] I just read about.

The Class as a Chorus: We're up for it, Mr. Fields!

Sid: We'll use **behavioral skills training (BST)** so you can learn how to knock your interviews out of the park.

Tom: What's BST?

** Tech Talk: *Replicate* just means *repeat*. In other words, Sid wants to repeat the experiment, with the hope of getting results like the original researchers got.

Max: Remember, it's four steps:

1. You tell the student what the skill is and why it's important.
2. You model (demonstrate) the skill.
3. The student practices the skill.
4. And you give feedback on what the student's doing right and what they can improve.

Definition: CONCEPT

Behavioral skills training (BST)

- Instructions,
- modeling,
- practice, and
- feedback.

So, Sid did BST with each of his students individually on each of the following individual skills: how to ask questions, how to answer questions, and how frequently and when to smile. For example:

- Questions the interviewee should be ready to answer:
    - What aspect of this job/program attracts you the most?
    - What do you know about our company/program?
    - What kind of experience do you have in the field?
- Questions interviewee might be ready to ask:
    - I read on the website that your company offers on-the-job training; would you tell me more about what that entails?
    - What are the ideal qualities of someone who would succeed in the company or at this position?
    - What do most students do after graduating from this program?

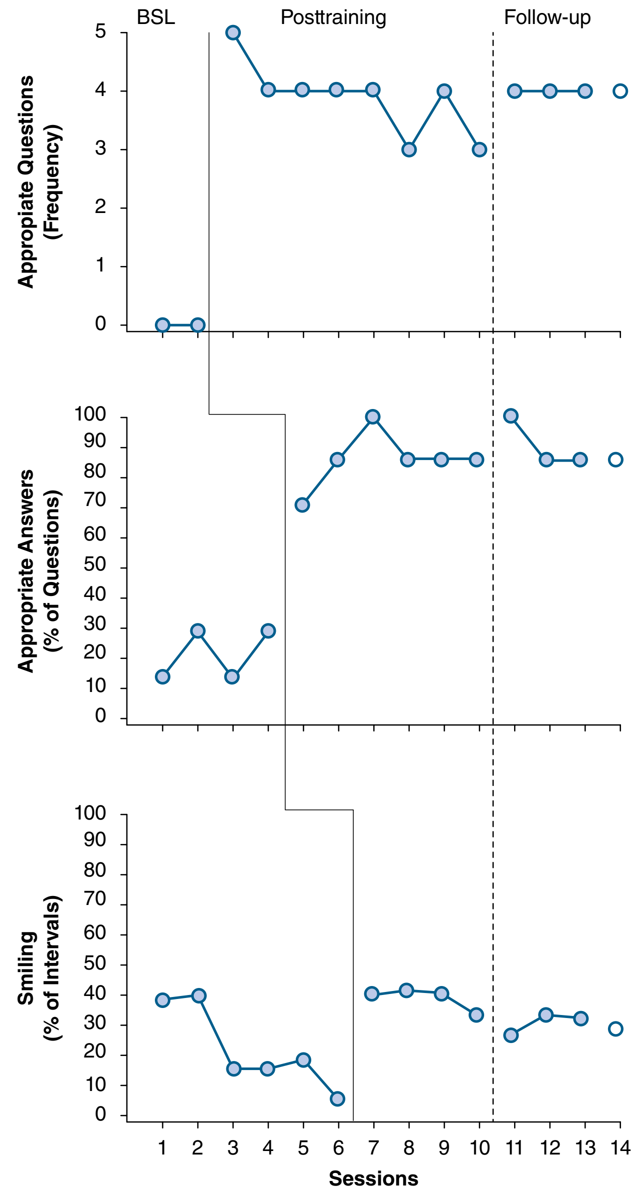


Figure 4.3 Joe's interview data.*

But before Sid and his crew started their BST, scientist Sid got some baseline data. He did trial interviews with each student and recorded the various responses each student made, for example how many times Joe asked cool questions, the percentage of questions he gave good answers to, and the percentage of times he was smiling (each 10-second interval was considered an opportunity for a smile). And you can see in Figure 4.3 that during baseline, Joe didn't ask any appropriate questions, made few correct answers, and his smiling fell apart across the trial interview sessions. So, he had plenty of room for improvement.

Also, in Figure 4.3, the stair-step line at the end of each baseline indicates when Sid did his BST for each skill. In other words, he did the training between the baseline sessions and the post-training sessions. (But the graph doesn't show Joe's behavior during the actual training, just his behavior before and after training.)

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* By the way, we use bar graphs in the main part of this book because they show the results in a quick and dramatic way, but behavior analysts usually use more detailed line graphs that show the change in performance over time, that show trends in the data, like this graph. That way, they can do more detailed analyses of the effects of the independent variable on the dependent variable. And of course, these are really Stocco, Thompson, and Hart's 2017 data, not our fictional Joe and Sid's.

Also notice something a little weird about the way Sid got those baseline data; he recorded questions for two sessions, answers for four, and smiles for six. Why? Because he wanted to apply his independent variable, BST, at different times for each dependent variable. Why? Because he wanted to make it real clear that it was his BST that caused the improvement in Joe's dependent variable, not just some weird coincidence. Like maybe Joe'd seen a YouTube video on interviewing while he was getting Sid's BST. And maybe it was the YouTube that improved all three skills, not Sid's BST. Could be because maybe the baseline sessions had gotten Joe curious about this interviewing stuff and he YouTubed it.

To rule that out, Sid started the three different BSTs at three different times, which made it unlikely that any improvements in Joe's performance could be due to three different videos, or to changes in the weather, or to changes in the quality of Joe's romantic life.

And, as the post-training sessions show, the improvements for each skill immediately followed the BST for that skill, making it very unlikely those improvements were caused by anything other than Sid's BST.

Of course, we have a name for this sort of experimental arrangement—***multiple baseline design***.*

Definition: CONCEPT

Multiple-baseline design

- An experimental design
- in which the replications involve
- baselines of differing durations
- and interventions of differing starting times.

In Sid's case, his replications involve repeating his BST with Joe for three different skills, to see if he'd get the same results. And he also replicated the same BST with several different students, to see if he'd get the same results. And each replication that produces the same results increases our confidence that we've discovered a cause-effect relationship, a causal relationship.

* Tech Talk: When we scientists say ***experimental design***, we're talking about our arrangement of the independent and dependent variable to demonstrate a cause-effect relationship; and we also use ***research design*** to mean the same thing. And when we say ***replicate***, all we mean is to carefully repeat.

By the way, here's something I really like about this study—the real researchers, Stocco, Thompson, and Hart, and of course our fictional Sid ran follow-up sessions 9 weeks after the original post-training sessions to see how well the improved skills maintained. In other words, they weren't satisfied just to show that their behavior skills training worked; they also wanted to see if the new skill lasted long enough to be practical. And in the two cases where they didn't last, the researchers added some booster sessions to get their participants' skills back up to speed. They were dealing with real people they cared about, not just guinea pigs.

QUESTIONS

1. Define each of the following concepts:
   a. *behavior skills training*
   b. *multiple baseline*
2. Describe an experiment that illustrates these two concepts.

Concept

INTEROBSERVER AGREEMENT (C-1, C-8)

For an extra credit hour, Sid enlisted two other undergrads to help him with this experiment; they recorded the data that went into the graphs like the ones we just looked at. But before they could do the recording they had to be trained observers; they had to be able to recognize good and bad questions and answers and appropriate smiling. Sid provided **operational definitions** of each of the types of behavior they'd record and gave examples and non-examples to his research assistants. An **operational definition** makes it possible for two or more observers to identify the same behavior when it occurs. For example: If asked about experience, an appropriate answer would include academic and/or work experience relevant to the skills needed for the job or grad school. And appropriate questions for grad school applicants to ask would include those relevant to the specific grad program, like *What kind of practica do you offer?* And appropriate posture would not only include the participant's back against the chair but also their not fidgeting, like stroking their hair, jiggling their leg, or tapping their pen.

Then using videos of interviews, the assistants practiced recording instances of appropriate questioning, answering, and smiling until they achieved an accuracy of at least 80% correct. After this training, the two assistants independently observed the videos of Sid's students from their interview sessions and wrote down each instance of the three behaviors they saw, i.e., they were observing and recording the dependent variables. And like all good behavioral researchers, Sid measured their **interobserver agreement**. He did this by computing how often the two assistants agreed in their observations divided by their total number of observations. This way Sid could assess the reliability of his measurement procedure. Sometimes this can get a little tricky when we're measuring complex human behavior. And usually 80% agreement among observers is considered reliable enough.

Definition: CONCEPT

Operational definition

- An explicit definition
- that makes it possible for two or more observers
- to identify the same behavior when it occurs.

Definition: CONCEPT

Interobserver agreement

- Agreement between
- observations of
- two or more independent observers.

QUESTIONS

1. *Operational definition*—describe it and give an example.
2. *Interobserver agreement*—describe it and give an example.

SINGLE-SUBJECT VS. GROUP EXPERIMENTAL DESIGN (D-4)

The goal of scientific research is usually to see if the independent variable causes a change in the dependent variable. Does Sid's training program cause an improvement in his students' interview skills? To answer this, we need to compare their interview skills after the training with the interview skills of people who haven't had the training. Now, Sid did this by comparing his students' individual post-training skills with their own pre-training skills, their individual skills measured during baseline.

In other words, Sid used a **single-subject** experimental design. His senior students were the subjects (participants) in this experimental research. And he measured each of their performances before training (i.e., during baseline) and also after training. So he did a complete experiment on each participant, and he replicated this experiment with each of the participants in this research project. We call it a *single-subject experimental design*, because for each participant we compared their performance before training with their performance after training. But, a *single-subject experimental design* doesn't mean only a single participant was in the experiment.

Suppose Sid hadn't measured his students' interview skills before his training; suppose he'd only measured their skills after his training, and then he'd claimed that his training was the cause of their fairly high skill level? Well, though you haven't even finished this research methods chapter, you're smart enough to know that'd be disappointingly dumb of Sid. Right? You'd ask Sid, "How in the heck do you know your students didn't have those skills before you did the training? Come on, Sid, how do you know your training improved those skills?" So, even though Sid hadn't gotten his PhD degree yet, he'd still know more than you do; he measured their skills before his training, during the baseline, during what we can call the ***control condition***. (Tech Talk: We say the baseline *controls* for the possibility that his students already had those skills. In other words, it *rules out* that possibility, or at least it lets us evaluate that possibility.)

And, if he'd used a group research design, he might have randomly assigned half his participants to the group that got no training (**control group**) and half to the group that got the training (**experimental group**). Then by comparing the interview skill of the two groups, he'd have seen if his training, the independent variable, had an effect on their interview skills, the dependent variable. So, a *group design* is one where we would apply one value of the independent variable to one group and another value to another group. In other words, using a control group would let us control for the possibility that our independent variable, the training, didn't really affect our dependent variable, the interview skills.

A problem with group research designs is that they usually involve comparing the average dependent variable measured for the experimental group with that measured for the control group; but then you can't see the performance of the individual participants. For example, some of the students might have improved their performance, some might not have, and some might even have gotten worse. In fact, the actual cigarette smoking study had two participants; one was fairly successful in decreasing her smoking ("Dawn"), and the other failed to decrease her carbon monoxide level and only slightly decreased her reported cigarettes smoked. Also, she reported smoking twice as much as "Dawn" did during baseline. If this had been a group design and they'd have averaged the results for the two participants, the researchers would have lost sight of those important individual differences. Therefore, most research in behavior analysis uses a single-subject experimental design that allows us to see the details of the performance of each unique individual. But sometimes group designs are also useful.

QUESTION

1. What's the advantage of single-subject vs. group experimental design?

Concept

EXPERIMENTAL AND CONTROL GROUPS (D-3)

And a little more about group experimental design:

Dr. Siqueland showed that 4-month-old babies could learn simple responses as a result of the process of reinforcement.[3] This is important because it says that the principles of reinforcement may be crucial to the early acquisition of effective repertoires in infants. And that causes us to question the traditional notion that infants simply develop, lying in their cribs or playpens, just like potted plants develop, rooted in their pots.

Siqueland worked with a group of 4-month-old infants. In the experimental sessions, he gave them some milk as the presumed reinforcer each time they turned their heads. Here's what he got: an increase in the frequency of their head turning.

Reinforcement? It looks like it, but could it be that old devil coincidence? Probably not, because he got these results with several babies, not just one. Good, but could it be an excitatory effect from the stimulation of the milk? Again, maybe they're just moving around more, and head turning is one thing they're doing when they get that exciting milk.

Well, Siqueland asked that same question. Except he controlled for that possibility using a group design, somewhat like the hypothetical one Sid could have used to assess his interview-skills-training procedure. Siqueland used a group research design. Typically, a group research design uses two different groups, the *experimental group* and the *control group*.

The experimental group is the group that gets the special intervention (e.g., reinforcement).

Definition: CONCEPT

Experimental group

- A group of participants
- exposed to the presumed crucial value of the independent variable.

And the control group is the group that does not get the special intervention (e.g., no reinforcement, in other words, extinction).

Definition: CONCEPT

Control group

- A group of participants
- not exposed to the presumed crucial value of the independent variable.

The control group is important, because a comparison between the experimental group and the control group shows whether the experimental intervention really was crucial to the results obtained.

In Siqueland's research, each infant in the experimental group got the presumed reinforcer of the milk, contingent on head turning. And each infant in the control group got the milk every now and then, whether or not the infant had turned his or her head. This is called a *variable-time schedule*, where the event (delivery of the milk) is independent of responding (head turning). The results were that the infants in the experimental group increased their head turning and those in the control group did not. The only difference was the contingency, whether the delivery of the milk was contingent on the head-turning response. So, the contingency was crucial to the results. Siqueland had controlled for any excitatory effect that might have resulted from the mere delivery of the milk and had still gotten an increased frequency of head turning. So Siqueland had demonstrated reinforcement.

Science depends on the general procedure of controlling for the effects of extraneous factors. Control procedures, such as control groups, help make the scientific method the most reliable way of finding out about the world.

Definition: CONCEPTS*

Single-subject experimental design

- Individuals serve as their own controls.

Group experimental design

- A separate group of individuals serves as the control for the experimental group.

In other words, in a **single-subject experimental design**, all the different values of the independent variable are applied to a single participant (subject). And in a **group experimental design**, each different value of the independent variable is applied to a different group of participants.

Sid's cigarette-cessation program for Dawn involved a **single-subject experimental design** to demonstrate the effectiveness of the performance-management contingency involving the money reinforcer. The baseline, where there was no money contingency, was the control condition. And this performance-management contingency worked, at least for Dawn. We'd need to replicate this with several smokers to determine how generally effective it is. But Dawn's case was a nice start.

QUESTIONS

1. Define and give an example of each of the following:
   a. *experimental group*
   b. *control group*
2. What is the function of a control group?
3. Define and give an example of single-subject and of group experimental designs.
4. Define and give an example of each of the following:
   a. *single-subject experimental design*
   b. *group experimental design*

Concept

SOCIAL VALIDITY (H-3)

In addition to measuring his students' interviewing skills, Sid also wanted to know what they thought about the whole thing. Did they like the training procedure? Their mean was 6.4 on a 7-point scale, with the range 5 to 7. Happy with their improvements? Mean = 6.6 and range = 6–7. Showing the range of scores gives us some idea of how typical the mean is of all the individuals. So, yeah, they were happy students.

In applied research, it's important that the participants are happy with the goals, accomplishments, and the procedures used to accomplish those goals. **Social validity** tells us whether we have selected what our clients consider socially significant **target behaviors**—*those worthy of improving*. Social validity also tells us whether we have an acceptable intervention, to some extent regardless of its outcome.

Definition: CONCEPTS

Social validity

- The goals,
- procedures, and
- results of an intervention
- are socially acceptable to the client,
- the behavior analyst, and
- society.[4]

Target behavior

- The behavior being measured,
- the dependent variable.

Van Houten pointed out that we should use social validity procedures to determine the target behavior, optimal levels of the target behavior, and intervention results.[5] We'll fail if the intervention stops below the lower limit the community

* Some researchers prefer to use the terminology *within*-subject research (experimental) design rather than *single*-subject (experimental) design because it emphasizes that you're comparing the performance of each individual participant during an experimental condition with that participant's performance during a control condition, even though you may make these within-participant comparisons with a large number of individual participants. And they prefer *between*-subject research (experimental) design rather than *group* research (experimental) design because it emphasizes that you're comparing the performance of one group of participants during an experimental condition with the performance of one group of participants during a control condition.

expects for competent performance. A behavioral intervention might improve a student's grades from *F*s to *D*s, but the community might not consider *D*s good enough. Also, a complete social validity evaluation will tell us how acceptable our intervention is. For example, even though the student may have gotten straight *A*s, we've failed if our intervention required more work from the teachers than they believed appropriate. In other words, without assessing the social validity, we behavior analysts might feel our intervention had succeeded, but social validity might show the contrary.

QUESTIONS

1. Define *social validity* and give an example.
2. Define *target behavior* and give an example.

Concept

INTERNAL VALIDITY

Suppose Sid not only gave Dawn money on the days when she refrained from smoking, but suppose he also gave her hell on the days when she did smoke. And suppose she stopped smoking. Well, we wouldn't be able to tell whether it was the dollars, the hells, or the combination of the two that got the nicotine monkey off her back. He had confused the two independent variables, the dollars and the hells. Or as we scientists prefer to say, he had **confounded** the independent variables.

Definition: CONCEPT

Confounded variables

- Two or more independent variables have changed at the same time,
- so it is not possible to determine which of those variables caused the changes in the dependent variable.

An internally valid study is one in which no more than one independent variable is presented at the same time (the independent variables aren't confounded). If you don't confound or mix together two or more independent variables, you are better able to determine which independent variable (or variables) is responsible for changes in the dependent variable. This is called **internal validity** because the experiment is valid or correct within itself; it validly answers the question that the experimenter's trying to answer; for example, *will the dollar behavioral contingency help Dawn stop smoking?*

Definition: CONCEPT

Internal validity

- Lack of confounding variables.

QUESTIONS

1. *Confounded variables*—define it and give an example.
2. *Internal validity*—define it and give an example.

Concept

TREATMENT PACKAGE (E-9)

Yes, we scientists are always trying to *understand the world*, always searching the truth, always trying to do research that's internally valid, that has no confounding variables. But we behavior analysts don't always have our scientist hat on. Often, we have our practitioner hat on, as we're trying to *help the world*, the sweet little kid right in front of us, the kid who has a high rate of dangerous behavior, serious self-injury, and high-risk elopement. We might first want to throw the kitchen sink at the problem behavior, all the independent variables we can think of that might reduce the problem behavior. And we call this kitchen sink of independent variables the **treatment package**.

Definition: CONCEPT

Treatment (intervention) package

- The addition or change of several independent variables
- at the same time
- to achieve a desired result,
- without testing the effects of each variable individually.

Sydney ran into a fairly common problem when trying to take students with autism into the community. For example, 5-year-old Cooper loved to run. He loved it so much that his parents were afraid to take him out in public because the second they turned their head, he would take off. Elopement, or running away from a caregiver, is such a common problem for children with autism that an estimated 49% of them have been reported to elope. This is especially concerning because children who elope are more at risk for drowning and traffic injuries.[6]

This was such a serious concern for Cooper and his family that Sydney decided to use a **treatment package** to decrease Cooper's eloping.[7] And because treatment packages involve **confounded variables** (more than one independent variable is introduced at one time), it won't be possible to determine which of those variables was the crucial one that caused the change in Cooper's behavior.

In Cooper's case, Sydney used a treatment package that involved three components—differential reinforcement, blocking, and time-out. She used differential positive reinforcement for appropriate walking. Every few seconds that Cooper walked next to her without running, Sydney praised him. But if Cooper got more than an arm's reach away from her, she stopped delivering social praise *and* blocked him from getting away. After she blocked his attempt to elope, she returned him to the original location, where he was required to stand in place for 10 seconds without moving (i.e., a time-out from walking/running).

And her treatment package worked, she pretty much got rid of all of Cooper's elopement while she was with him in public. Whew! Yes, it was more than worth the effort. The moral: If your main goal is to help the person rather than to do research with perfect internal validity, a treatment package may be your best friend.[8]

By the way, when Dawn read this section on treatment packages, she asked Sid why he hadn't used a treatment package with her, like one that might have been more likely to work, even if it involved the confounding of dollars and hell. She said that's what he should have done if he really cared about her and their future child.

QUESTION

1. *Treatment (intervention) package*—define it and give an example, explaining why you might use one.

Concept

REVERSAL DESIGN (D-5)

Mae's teachers gave the children toys only when they asked for them using color-noun combinations, for example, *green car*, *red apple*. Following this intervention, the frequency of using color-noun combinations increased from 0.4 to 14.2 an hour. But this simple baseline design didn't allow Mae to be completely sure her intervention had increased behavior. Maybe the increase in color-noun combinations would have occurred anyhow. Maybe some confounding variable had really caused the increase in the color-noun frequency. How could Mae find out if her intervention had made the difference?

She asked her teachers to remove the intervention (in other words, to reverse to the original baseline condition). This is called a **reversal design**. During this reversal to the baseline condition, the children got snacks and materials regardless of whether they used a noun alone or a color-noun combination. Mae kept this reversal to baseline conditions going for the next 18 days. And, sure enough, the frequency of using color-noun combinations decreased to 7.4 per hour.[9] Now she was more confident that requiring her students to use the color-noun combinations had increased their frequency. In fact, she was confident enough that she didn't keep the baseline going for longer than 18 days to see if the frequency of color-noun combinations would have eventually dropped to the original baseline frequency of 0.4 per hour.

Definition: CONCEPT

Reversal design

- An experimental design
- in which we reverse
- the intervention and baseline conditions
- to assess the effects of those conditions.

Behavior analysts often call the reversal design an ***ABA design***. *A* stands for the baseline condition and *B* for the intervention. In an ABA design, a second baseline phase follows the intervention. Usually, if the performances in both baseline conditions are similar to each other and different from the intervention, you can be fairly sure that the intervention is what changed the performance. Most likely, you've ruled out any confounding variables. Consecutive ABA replications, like ABABABA, increase the internal validity. The reversal design provides more convincing evidence than the simple baseline (or AB) design that the intervention is responsible for the change.

But fortunately, we can't reverse some processes—for example, the training processes. If we implement a training program to teach someone to drive a car, when we stop the training program, the natural reinforcers will maintain the person's driving skills without our continued training. So we couldn't use the reversal design to demonstrate effectiveness of our training program.

Same with Dawn's smoking cessation program. So, in her case, why are we returning to baseline? With the hope that she won't start smoking again, with the hope that our program did the trick, not to demonstrate that the independent variable is really what affected the dependent variable.

By the way, ***research design*** means the way you arrange the various conditions of your experiment or intervention, and the *reversal design* is one type of research design. We sometimes call the *reversal design* an *ABA design*, where the first *A* refers to the first baseline condition, *B* to the experimental intervention, and the final *A* to the reversal back to the baseline condition. The *simple baseline design* with no reversals is another type of research design. An intervention, without measuring performance during baseline, might be an example of a *case study*—a weaker research design.

QUESTIONS

1. *Reversal design*—define it and give an example.
2. Explain why the reversal design can be better than a simple-baseline design.

Concept

CHANGING-CRITERION DESIGN (D-5) (G-19)

Every day for the last 2 months you've resolved to start exercising—tomorrow. Yet you've never gotten into your exercise clothes, visited the gym, attempted to jog, or done any exercise, except for your regular daily activities, like pushing the buttons on the remote control of your TV. But you really do want to get in shape.

When all else fails, people turn to applied behavior analysis for help. So do you. You go to stickK.com* for help. At this self-management website, you set up a contingency contract. With your credit card, you agree to pay some penalty every time you fail to achieve your goal, you know, like $5/day or $55/day, depending on the size of the allowance Mommy's giving you. But this is the penalty if you screw up; stickK, itself, is free. For example, you'll lose $5 every weekday you fail to exercise at the university gym and report on it to stickK.

Because you're so out of shape, you think 10 minutes of exercise a day is good enough for openers. So, for each day you don't exercise for 10 consecutive minutes, you lose $5. After a few weeks of consistent performance at around 10 minutes a day, 5 days a week, you up the minimum criterion to 20 minutes a day. Now if you continue to exercise for only 10 minutes, you'll lose $5. Every few weeks, you raise your exercise criterion by 10 minutes until you hit 60 minutes a day. And your performance rises to match whatever criterion is in effect on that day. You fail to hit criterion only three times, and rarely do you exceed it by more than a few minutes.

After 6 months, you start to wonder if the contingency contracting's worth it. There's the daily hassle, small though it is. Maybe the contingency contracting wasn't really crucial to your success. Maybe you should kiss stickK good-bye and continue to exercise on your own.

But you're nervous. You're on a roll with stickK International. And you're afraid that if you stop contingency contracting and your exercise falls apart, you may need another 5 years before you get your act together enough to give it another shot. You tell your troubles to a sympathetic classmate, and she tells you that if you read the next couple paragraphs, you'll find a solution. It's called the **changing-criterion design**.

The changing-criterion design is a special type of experimental design in which the experimenter repeats the experiment with differing values of the independent variable and measures changes in the dependent variable. If the values of the dependent variable change systematically with the changes in the independent variable, coincidental confounding variables are probably eliminated. Then we have internal validity, and there is probably a causal or functional relation between the independent and the dependent variables. In the case of the changing-criterion design, the value of the independent variable that is being changed is the criterion required to meet a behavioral contingency.

Definition: CONCEPT

Changing-criterion design

- An experimental design
- in which the replications involve
- interventions with criteria of differing values.

* Yes, there really is a stickK.com. Check it out @ www.stickk.com. It's an online contingency-contracting website designed to help you get your act together—very impressive, and most importantly, you can share your successes with your Facebook friends.

And in the case of your contingency contract, that criterion being changed is the number of minutes you need to exercise to avoid the $5 loss. Your classmate points out that your amount of exercise has varied systematically and abruptly every time you change your criterion. This means that something about the intervention package of your contingency contract is crucial. You don't know whether you need all the components—the daily goal, the daily reporting to stickK, and the potential $5 loss—but you can be confident that at least some of those components are crucial. With your changing-criterion experimental design, you've shown a causal or functional relation between your contracting and your amount of exercise.

Let me add some personal data to these hypothetical data. In my younger days, when I was writing this section for the 2nd edition of this book, I was training to run a marathon and was contracting with stickK to run either 6, 12, or 18 miles each day. Otherwise, I, too, paid $5. I never ran 18 miles when I could run 12, and I never ran 12 when I could run 6. And I almost never had to pay the $5. This informal changing-criterion design convinced me that my performance in the marathon that spring hung by the fragile thread of my contingency contract with stickK.

All experimental designs involve some sort of comparison between two different conditions, between an experimental condition and a control condition or between various experimental conditions. We just saw that the changing-criterion design involves comparisons of performance between differing response requirements (e.g., differing amounts of exercise required to avoid paying a fine, differing forces of a lever press to get the water reinforcer, or differing percentages of completed homework problems to get an *A*). If the performance tends to match the different criteria, we are safe in concluding that the contingency we're using is controlling behavior. This is an excellent research design, but it is limited to evaluating the effectiveness of behavioral contingencies. The next design is more general.

Concept

ALTERNATING-TREATMENTS DESIGN (D-4) (D-5)

David was 21 years old and had lived in an institution for individuals with intellectual disabilities for the past 9 years. He had a high frequency of stereotypic behaviors, such as weaving his head, staring at his hands, and repeatedly manipulating objects. These stereotyped behaviors prevented him from taking part in vocational placement, from learning new skills that could increase his quality of life, and they embarrassed his family.

Jordan, Singh, and Repp[10] used an **alternating-treatments design** to compare the effectiveness of visual screening, gentle teaching, and baseline conditions. Visual screening consisted of a punishment contingency, in which the trainer covered David's eyes with one hand and held the back of his head with another hand for 5 seconds contingent on the occurrence of a stereotyped behavior. Gentle teaching consisted of using almost no vocal instructions, only gestures and signals. This intervention included a combination of physical guidance, reinforcement of the desirable behavior, and extinction of the undesirable behavior, but no punishment. During baseline, no procedure was in effect.

The experimenters did their research by implementing the three different procedures, in three different 30-minute training sessions, all three on each day of training. In other words, within each day, they alternated between the three experimental conditions—visual screening, gentle teaching, and baseline. Behavior-analytic experimenters use such an alternating-treatments design to compare two or more interventions using the same participant.

Definition: CONCEPT

Alternating-treatments design

- An experimental design
- in which the replications involve
- presenting different values of the independent variable
- in an alternating sequence
- under the same general conditions
- or in the same experimental phase,
- while measuring the same dependent variables.

In other words, you go back and forth between two or more specific treatments (values of the independent variable) with a single participant.

To appreciate the value of this experimental design, let's compare it with a couple of others. The experimenters might have used a ***between-subjects*** or ***between-groups experimental design***. They could have used gentle teaching with one client or group of clients, visual screening with a second, and baseline conditions with a third. Then they could have compared the amount of stereotyped self-stimulation among the three clients or groups.

The experimenters couldn't have been sure the differences in self-stimulation were due to their three different experimental conditions (interventions) if they had used three different clients. The problem is that it's too hard to be sure you've really got three equal clients. Maybe the three clients had different rates of self-stimulation to begin with. Or maybe they weren't equally influenced by the interventions. This raises the possibility that the differences between the results obtained with the three interventions might have been attributed to the differences between the three clients. So it's too hard to rule out the confounding variable of the different clients.

There are a couple of problems with a between-groups design in which you would randomly assign a large group of clients to each of the three interventions and compare their performances. First, it's hard to get large groups of clients with similar behavioral problems. And second, it's easy to lose sight of the details of the effects of the interventions when your data consist of group averages rather than the performance of individual clients.

Another approach would have been to work only with David, but to use the three conditions successively, perhaps a week of baseline, a week of gentle teaching, followed by a week of visual screening. But then it's not easy to be sure that the 3 weeks were comparable. Maybe 1 week was hotter than the others. Or maybe David would have done less self-stimulation during the third week no matter which condition was in effect. Perhaps his self-stimulation would have decreased as a function of his becoming more familiar with the trainers. In other words, maybe the differences between the three conditions of intervention had nothing to do with the interventions. Such a design would have made it difficult to rule out these and other confounding variables that would have threatened the internal validity of the experiment.

The alternating-treatments design elegantly dealt with all these problems. It ensured that the participants in the three experimental conditions were alike, by using the same participant—David. And it ensured that the days of exposure to the three conditions were alike, by using all three conditions on the same day (but in a different order each day).

However, the experimenters had to pay a price for using this design. The price was the potential for an ***experimental interaction***. Experimental interaction is a risk you always run when you expose an experimental participant to more than one experimental condition. The risk of interaction is that exposure to one condition may have influenced the effects of another condition. For example, the advocates of gentle teaching might argue that gentle teaching would have been much more effective if the experimenters had not also exposed David to the punishment contingency involving visual screening. The risk of this sort of interaction is higher because the experimenters used the same trainers, tasks, and setting with David.

So, here are advantages of the alternating-treatments design:

- The participant is the same during all treatments.
- The conditions of the treatment are essentially the same.
- Single-participant data can be analyzed, rather than averaged data.

And here is a disadvantage of the alternating-treatments design:

- Experimental interactions cannot be ruled out.

Rarely does a single experiment decide complex theoretical and practical issues such as gentle teaching vs. punishment contingencies. We will need many more such careful experiments, conducted by both the advocates of gentle teaching and the advocates of punishment contingencies. But each experiment, with its design strengths and design compromises, moves us closer to an understanding of how the world works and how to help the world work better.

Oh my gosh, we got so wrapped up in discussing research methods that we forgot all about David and also about the two competing interventions. Well, David's stereotypy occurred 96% of the time when he was just hanging out, and it reduced to 45% when a behavioral approach was used to teach him a task, i.e., when he was given something structured to do. And then during the alternating treatments, gentle teaching had no effect, but visual screening immediately reduced David's stereotypy to only 14%, not much higher than for some of us.*

Also, this experiment is a good example of the virtues of single-subject vs. group experimental designs. There were actually three subjects. Kevin's results were much like David's. But gentle screening had no lasting effect for Paul. However, this important difference between people would have been lost in a group design, where the data for the three guys would have been averaged, and we wouldn't have seen that gentle teaching doesn't work at all for some people. Yes, we behavior analysts have a strong bias toward single-subject research

* I'm little embarrassed to say this, but somewhere between the *PoB* 2e and 8e, we got so involved with research methods that we lost sight of what happened to David and which procedure was more effective. And, also, no reader, student, or instructor has called this to our attention. We do have to be careful that we don't get so involved with our science that we forget about people.

design. However, there are some occasions where group design is the best option, like often when we're doing traffic safety research to find out what general safety procedure will be best for the most people.

QUESTIONS

1. Define and give an example of the following research designs:
   a. changing criterion
   b. *alternating treatments*
2. What are two advantages of the *alternating-treatments design*? What is a disadvantage?
3. *Experimental interaction*—give an example.

Concept

CONTROL CONDITION

The major use of a control condition is to control for possible confounding between the presumed independent variable and other changes in the person's life. You compare the intervention condition with the baseline condition. We call this comparison condition the **control condition** because it helps us rule out or control for a possible confounding.

Definition: CONCEPT

Control condition

- A condition not containing the presumed crucial value of the independent variable.

The control condition is important because a comparison between the intervention condition and the control condition shows whether the value of the independent variable really was crucial to the results obtained.

Incidentally, behavior analysts also often make temporary use of extinction as a control condition. They use extinction in reversal designs to show that their presumed reinforcer really is a reinforcer. For example, suppose you want to find out if your smile really is the fantastic reinforcer you think it is for the preschooler you're teaching to read. Suppose you've been reinforcing sentence reading with your warm smiles. During the control condition, stop smiling awhile and see what happens to the frequency of reading. Does it remain unchanged? Hmmm.

QUESTION

1. *Control condition*—define it, give an example, and explain its importance by referring to your example.

Concept

GENERALITY OF RESULTS (D-2)

In this chapter, we've emphasized the importance of doing research that will contribute to the well-being of the universe. And we've pointed out that science in general, and behavior analysis in particular, can contribute in two ways. First, science can contribute as a means toward an end, as a means toward better physical and behavioral health. But it can also contribute as an end in its own right: Knowing how things in the physical, biological, and behavioral worlds work makes it more reinforcing to be alive, just as art, music, and sports do, even if they turn out to be of little utilitarian value.

We've discussed the role of research methods in making sure we discover valid cause-effect or functional relationships—**internal validity**. Finally, let's address the notion of **external validity** or generality of results. External validity means the extent to which the cause-effect relation or functional relation you've shown in your experiment is valid under conditions external to your experiment. External validity means the generality of your results. For example, imagine this:

In the 1930s, Skinner put a small number of simple rats in a small number of simple Skinner boxes, along with a small number of simple behavioral contingencies. He discovered a small number of simple behavioral principles and concepts. No big deal, perhaps. But over the next 80-some years, a few thousand behavior analysts, both scientists and practitioners, discovered that those simple principles and concepts applied to essentially all endeavors of the human and the nonhuman animal. Furthermore, they discovered that the applications of the principles of behavior could improve those endeavors, no matter what those endeavors were. Skinner's results with the rats in his experimental box generalized to children with intellectual disabilities learning to tie their shoes, to parents trying to coexist peacefully with their children, to doctoral students trying to complete their dissertations, and to corporate presidents trying to make a profit and benefit their employees at the same time. Now that's **external validity**!

Definition: CONCEPT

External validity

- The extent to which the conclusions of an experiment
- apply to a wide variety of conditions.

QUESTIONS

1. *External validity*—define it and give an example.
2. What is the difference between *internal* and *external validity*?

THE GOALS OF BEHAVIOR ANALYSIS AS A SCIENCE (A-1)

Description

According to the National Center for Educational Statistics (NCES), 21 percent of adults in the United States (about 43 million) fall into the illiterate/functionally illiterate category.[11] So illiteracy is a big deal in the United States and, of course, everyplace else too. And we'd say this is a *scientific fact*. In other words, it's not just an opinion, or a fear; this large amount of illiteracy is a *scientific fact*. And what does that mean? People, *scientists*, carefully measured the reading skills of a random sample of Americans, and that's the result, the *scientific* result. So that's one of the goals of science, including the science of behavior analysis, to be able to accurately ***describe*** behaviors of interest, including the behavior of reading.

Prediction (Correlation)

OK, so that's a scientific fact, but we want more than that: We want to be able to predict who can read and who can't. And here it is: *There is a direct correlation between poverty and illiteracy. Per the Literacy Project Foundation, three out of four people with such low income that they need public support also cannot read. Fifty percent of unemployed individuals between 16 and 21 years of age are not considered literate. On the flip side, as the literacy rate doubles, so doubles the per capita income*.[12] But what's going on here? What's the cause, and what's the effect? Does poverty cause illiteracy, or does illiteracy cause poverty? What's the independent variable, and what's the dependent variable? Well, at this point we don't have an independent variable; all we've got are two dependent variables that are related to each other; they're ***correlated***. In fact, they might both be the result of some third factor, the real independent variable. And if you've lived anything but the most sheltered life, you've heard this stereotypical answer from your bigoted Uncle Edward: *They're poor and illiterate because they're lazy*. And you might have replied, *That's not true! They have low incomes and a hard time with reading because of a lack of opportunity*. OK, what opportunity?

Well, Betty Hart and Todd Risley went in search of an answer to that question.[13] They looked at the vocabulary growth of 42 kids from when they were about 8 months old until they were 3 years old. And they found a strong ***correlation*** between the family income level and the kids' vocabulary, as you can see in Figure 4.4. The higher the income, the larger the vocabulary.

But still just a correlation between two dependent variables. And Hart and Risley wanted to know what the independent variable was. So, while they were recording the kids' vocabulary growth during those 2 1/2 years, they were also recording the number of words the parents said to their kids during their typical parent-kid interactions. And you can see in Figure 4.5, once again, there's a strong relation between the number of words the parents said during those first 3 years and the family income level. Or, put another way, Hart and Risley had found that low-income parents said an average of 616 words per hour, working-class parents said 1,251 words per hour, and high-income parents said 2,153 words per hour.

But there's even more: The kids' vocabularies at age 3 were a strong predictor of not only their third-grade vocabularies

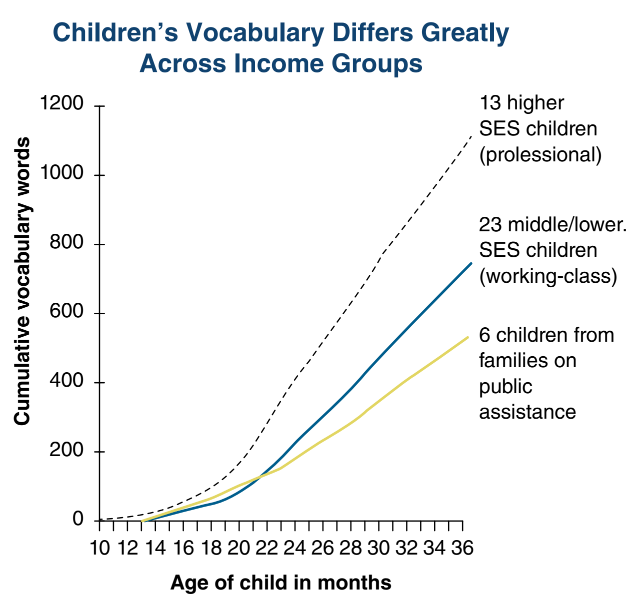

Figure 4.4 Vocabulary and Family Income

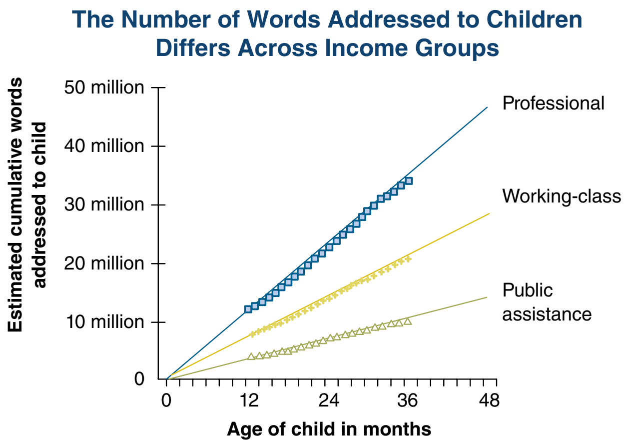

Figure 4.5 Words and Family Income

but also their third-grade reading skills, when they were 6 or 7 years older.

At last, Hart and Risley nailed it: The number of words mommies and daddies say to their kids is what causes their kids to have their small, medium, or large vocabularies! And that causes their success in school, years later. The number of parental words is the cause, the independent variable.

Control (Experimentation)

Well . . . not so fast. OK, so those correlations are also important scientific facts, but we want even more than that. We want to be able to do more than just predict who can read and who can't. We want to know what ***causes*** reading ability, yet all we've got are correlations, and ***correlations are not causal relations***. *Huh?* There's a strong correlation between the days when people wear sunglasses and when they also eat ice cream. *So?* But that doesn't mean wearing sunglasses causes us to eat ice cream or vice versa. *Got it*. And just because there's a strong correlation between parental words and kids' third-grade reading ability doesn't mean there's a causal relation.

Yeah, but what else could it be if it's not the word gap—what other cause could there be? What about other things correlated with poverty, like the quality of the schools, the quality of the diet and health care, sometimes even homelessness, all sorts of things? And, as we suggested a couple of minutes ago, there are even some, like bigoted Uncle Edward, who would say it's the parents' and kids' innate laziness.

So how do we find out? We do an experiment; we need to have an independent variable, a variable that experimenters themselves can increase and decrease. The experimenters need to be in charge of how many words are spoken to each kid to be sure it's not one of those other variables that determines the kids' third-grade reading ability. The experimenters need to be able to ***control*** the variable, in order to be sure that it really is an **independent variable**, the one causing the changes in the dependent variable.

How could we do an experiment like that? Well, we could try to convince high-income families to greatly reduce the number of words they said to their kids during their first 3 years of life. *But the families wouldn't be willing to do that*. I hope not, and even if they would, we wouldn't want to do anything to hurt their kids. *And the low-income families?* We could ask them to greatly increase the words they said to their kids. And to be sure, we could provide all the help they needed to get that word rate way up. *But we're still going to need a control group*. So, we take a random sample of the low-income families who are able to participate in our experiment; one-half get the big word boost, the experimental group, and the other half don't, the control group. *Fair enough*. Yes, especially because we wouldn't have enough resources or researchers to help all the low-income families get their word rates up. So those who weren't randomly selected to be in the experimental group would be in the control group. And so, by doing the experiment, we might get the knowledge we need to be sure that we can ***control*** the children's third-grade reading level by increasing their parental word usage. (By the way, note that we're using *control* with two different meanings. Earlier in this chapter we introduced *control* in the sense of control groups that prevented confounding.)

The Future Lies Ahead

That's great! This experiment proved that it's real important that parents talk a lot with their kids, even before they are 3 years old; that's what helps them read well, even as late as the third grade. Not so fast. As far as we can find out, that experiment has never been done.

Probably the most famous research in the history of applied behavior analysis is this correlational research by Hart and Risley. Like it's so well known that almost everyone concerned with literacy knows about Hart and Risley's famous *30-million-word gap*, the gap in words heard by age 3, between the number of kids from low-income families and high-income families. So famous that, back in the day, even President Obama knew about it and said, "By the time she turns 3 years old, a child born into a low-income home hears 30 million fewer words than a child from a well-off family."[14] And Obama went from word-gap words to word-gap action:

> Last week, the Obama Administration, in partnership with Too Small to Fail and the Urban Institute, hosted a group of federal, state and local policy makers, philanthropists, researchers and advocates at the White House for a day of shared learning on "Bridging the Word Gap." The convening is a follow-up to the President's call to action on early education and the word gap earlier this year.[15]

And partially as a result of Obama's efforts, there are major projects all over the country working hard to reduce that 30-million-word gap.

Irony

We behavior analysts take great pride in our field of behavior analysis because it's based on science, the best, most powerful kind of science, not mere fact, not mere correlations, but science based on experimentation, where we have ***control*** over the independent variable and can demonstrate real causal relations between two variables.

But it's ironic that our most famous research, one of those we take most pride in, is a mere correlational study. And I'm not sure, but I suspect most of us have not thought about it carefully enough to note that it was not actually experimental research.

By the way, I'm not being critical of the Hart and Risley study. I too think it's wonderful, but I sure hope that some of you reading this rant will be inspired to move our field significantly forward by actually doing some experimental studies of the relation between words at home and reading at school, rather than just relying on correlational studies.

Oh Yes

And don't forget that the goals of behavior analysis, as a science, are to be able to ***describe*** events, to be able to ***predict*** events (for which we only need a correlation), and to be able to ***control*** events (for which we need experimentation). Of course, correlation is not the only process that will allow you to accurately predict; so can experimentation, but experimentation is the only process that will allow you to accurately control.

Also, don't forget, as we preached in the beginning of this chapter, we should do behavior analysis for two reasons, (1) to **understand** the world and (2) to **build a better** world (save the world). And those three goals of behavior analysis (**describe**, **predict**, and **control**) are as essential both to understanding the world and to building a better world. Don't tell anyone, but I'd probably put it this way: Understanding and building a better world should be our main goals, and describing, predicting, and controlling behavior should be our sub-goals leading to those main goals!

QUESTIONS

1. Identify the three goals of behavior analysis as a science.
2. Discuss the role of correlation and experimentation in achieving those goals.
3. Discuss the Hart and Risley research in terms of those three goals and the role of correlation and experimentation.

Notes

1 Inspired by Redner, R., Robertson, N. & Lo, S. (2018). Application of a brief incentive treatment for cigarette smoking. *Behavior Analysis in Practice*, *11*(2), 154–159. The procedure was a little more complex than the one we described, but you can check out this reference for the details. Also, the reinforcement/penalty procedure is a little more complex than those we've discussed so far. It's typically called *differential reinforcement of other behavior, DRO* (Chapter 11).

2 Stocco, C. S., Thompson, R. H., & Hart, J. M. (2017). Improving the interview skills of college students using behavioral skills training. *Journal of Applied Behavior Analysis*, *50*, 495–510.

3 Based on Siqueland, E. R. (1964). Operant conditioning of head turning in 4 month old infants. *Psychological Science*, *1*, 233–224.

4 Based on Bernstein, G. S. (1989). In response: Social validity and the report of the ABA task force on right to effective treatment. *The Behavior Analyst*, *12*, 97; Wolf, M. M. (1978). Social validity: The case for subjective measurement, or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis*, *11*, 203–214.

5 Van Houten, R. (1979). Social validation: The evolution of standards of competency for target behaviors. *Journal of Applied Behavior Analysis*, *12*, 581–591.

6 Anderson, C., Law, J. K., Daniels, A., Rice, C., Mandell, D. S., Hagopian, L., & Law, P. A. (2012). Occurrence and family impact of elopement in children with autism spectrum disorders. *Pediatrics*, *130*(5), 870–877.

7 Harbaugh, S. M., Kohler, K. T., & Malott, R. W. (2016). *Reducing elopement using blocking, a time-out procedure, and differential reinforcement*. Unpublished manuscript.

8 For rationale on emphasizing outcomes over methods, check out Azrin, N. H. (1977). A strategy for applied research: Learning based but outcome oriented. *American Psychologist*, *32*(2), 140–149.

9 Would you be surprised to know that the real researchers on whose work our fiction is based got exactly the same results? See Hart, B. M., & Risley, T. R. (1968). Establishing use of descriptive adjectives in the spontaneous speech of disadvantaged preschool children. *Journal of Applied Behavior Analysis*, *1*, 109–120.

10 Jordan, J., Singh, N. N., & Repp, A. C. (1989). An evaluation of gentle teaching and visual screening in the reduction of stereotypy. *Journal of Applied Behavior Analysis*, *22*, 9–22. These behavior analysts were from the Templeton Hospital and Training Center, Educational Research and Services Center, Inc., and Northern Illinois University.

11 Rea, A. (2020, April 29). How serious is America's literacy problem? *Library Journal*. Retrieved from www.libraryjournal.com/?detailStory=How-Serious-Is-Americas-Literacy-Problem

12 Tkatchov, O. (2018, May 24). The correlation between poverty and illiteracy. *Medium*. Retrieved from https://medium.com/@orantkatchov/the-correlation-between-poverty-and-illiteracy-190ab4b4fbf6

13 Hart, B., & Risley, T. R. (2003). The early catastrophe: The 30-million-word gap by age 3. *American Educator*, 4–9. Retrieved from www.aft.org//sites/default/files/periodicals/TheEarlyCatastrophe.pdf

14 Kliegman, J. (2013, December 5). Obama says children from low-income families hear 30 million fewer words than peers by age 3. *Politifact*. Retrieved from www.politifact.com/factchecks/2013/dec/05/barack-obama/obama-says-children-low-income-families-hear-30-mi/

15 White House Hispanic Prosperity Initiative. (2014). *Bridging the word gap*. U.S. Department of Education. Retrieved from https://sites.ed.gov/hispanic-initiative/2015/05/bridging-the-word-gap/

CHAPTER 5

The Philosophy Supporting Behavior Analysis

Behavior Analyst Certification Board 5th Edition Task List Items		
A-2.	Explain the philosophical assumptions underlying the science of behavior analysis (e.g., selectionism, determinism, empiricism, parsimony, pragmatism).	Pages 68–70
A-3.	Describe and explain behavior from the perspective of radical behaviorism.	Pages 66–67
A-4.	Distinguish among behaviorism, the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis.	Pages 72–75
A-5.	Describe and define the dimensions of applied behavior analysis (Baer, Wolf, & Risley, 1968).	Page 79
B-1.	Define and provide examples of behavior, response, and response class.	Pages 71–72
C-2.	Distinguish among direct, indirect, and product measures of behavior.	Pages 79–80
D-5.	Use single-subject experimental designs (e.g., reversal, multiple baseline, multielement, changing criterion).	Pages 80–81
F-3.	Identify and prioritize socially significant behavior-change goals.	Page 79

Behaviorism (A-3, A-4)

Science has proven that there are superior races and inferior races, you know, like my race is clearly superior, and yours—well it's not as good as mine, but it's not the worst, you know, it's not as inferior as those other guys. So, what are we going to do about it? We're going to create a better world, by making sure that my race has a lot of kids and the races of those other guys with them bad genes have as few as possible.

And thus, from the gene, was born ***eugenics***, which has often argued that many important skills and behaviors are not learned but are genetically inherited: *You're born smart or dumb, honest or dishonest, industrious or lazy*, and on and on. And this eugenics view was very popular in the early 20th century, even among scientists; and, of course, it lingers on (*eugenics* is the breeding of human beings, so they'll have the heritable characteristics the breeder desires).

But, back in the day, at least a few people disagreed, including John B. Watson. Remember Watson from Chapter 1? Sure you do: He and Rosalie Rayner did, perhaps, the most notorious experiments in our field. Remember, they showed Little Albert a white rat and then immediately hammered a piece of metal, which scared the hell out of the poor little guy. This pairing respondently conditioned a fear response in Little Albert, so that now he also feared the white rat.

Well, controversial John B. Watson did something else that was very controversial, he said,

> *Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief and, yes, even beggarman and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors.*[1]

In other words, Watson was arguing against the popular eugenics movement; he was arguing that our behavioral history is very important, that we should not give more credit or blame to our genes than they deserve.

Unfortunately, this quote looks to many as if Watson were pounding his chest and bragging about his own fantastic training skills. But those critics may not have read his next sentence: *I am going beyond my facts and I admit it, but so have the advocates of the contrary* (the eugenicists) *and they have been doing it for many thousands of years*.[2]

In other words, Watson was battling those eugenicists who so frequently went beyond the science of genetics to create a pseudoscience in support of racism. And he was arguing against eugenics and racism, as part of his development of the philosophy of **behaviorism**, the philosophy that is the foundation of behavior analysis and the foundation of this book, *Principles of Behavior*.[3]

So, what is this philosophy of **behaviorism** I'm so excited about? Well, it's an effort to make psychology a real science, based on experimental research, like Pavlov did and Watson himself did, a real science, like physics, and chemistry, and biology, a real science that deals with physical reality. And psychology is an experimental science; psychologists should not just sit comfortably in their armchairs guessing about some nonphysical, nonmaterial psychological events, caused by some nonphysical, nonmaterial thing called the **mind**. And just what is this nonmaterial thing called the mind? Well that's not too clear; but, for sure, it's not physical, like your hands or your brain. It's more like a spirit or a ghost. Psychologists who claim to study the "mind" are called ***mentalists***.

And Watson's behaviorism is what we now call **methodological behaviorism**, the philosophy that we scientists should only deal with events that two or more scientists can observe. In other words, methodological behaviorists can only do experiments on what you say out loud, not what you think, because two or more scientists cannot observe your thoughts; they're private, just for you.

Ah, but we don't stop there. Skinner went beyond Watson's methodological behaviorism to develop the philosophy of **radical behaviorism**. He agreed with Watson about the difficulty of studying people's thoughts, because they're private and two or more people can't observe someone's thoughts. But, he said, that doesn't mean they don't exist; and also, these private events are behavior, just like our public behavior; and also number two, that means the principles of behavior apply to our private thoughts just like they do to our public behavior. The behavior of Rudolph's pressing the lever occurs because it's been reinforced, and the behavior of your talking occurs because it's been reinforced, and the radical behaviorist adds, *the behavior of your thinking also occurs because it's been reinforced*. The only difference between public and private behavior is that it's much harder to do scientific research on private behavior, but that doesn't mean it's any different from public behavior. So, now and then, radical behaviorists do slip back into their armchairs to do a little introspection and to speculate about their thoughts and about your thoughts too.[4]

But let's do a brief bounce back to "**mind**." What is it? A lot of disagreement about that. It may just be a collection of what people call "cognitive" activities, like thinking, imagining, remembering, being aware. Or it may be the cause of those activities. It may be physical, like your brain. Or it may be spiritual, nothing physical, nothing you can actually see or touch. Yeah, confusing. Philosophers and then psychologists have been fighting about this since Aristotle. But we behaviorists don't find the concept of "mind" very useful. So, if you don't mind, we'll just bag it and talk about behavior, and we radical behaviorists will talk about all those "cognitive" activities as behavior.

Definition: CONCEPTS

Behaviorism

- The philosophy that the subject matter of psychology is
- the study of the effects of environmental variables on behavior,
- largely through experimental analysis.

Methodological behaviorism

- The philosophy that behaviorism
- should only deal with events that
- two or more scientists can observe.

Radical behaviorism

- The philosophy that behaviorism
- can consider many private events as behavior
- to which the principles of behavior apply.

Mentalism

- The philosophy that the mind controls behavior.

Mind

- The source of cognitive skills or
- those cognitive skills themselves.

QUESTIONS

1. Define *behaviorism*.
2. Define *methodological behaviorism*.
3. Define *radical behaviorism*.
4. Define *mentalism*.
5. Define *mind*.

THE PHILOSOPHICAL ASSUMPTIONS UNDERLYING BEHAVIOR ANALYSIS (A-2)

Behaviorism shares several philosophical assumptions with the other natural sciences such as physics, chemistry, and biology, so let's take a brief look at them.

The Attitudes of Science[5]

A story is told about a reformed alcoholic and his wife, who was not so sure he was completely reformed. One day, while on a ski trip, the man fell and broke his leg. With the help of his wife he hobbled his way to a deserted hut, which incidentally was filled with many bottles of brandy. Since the man was in such pain, he suggested that he stay in the hut while his wife went for help. She agreed, but only after she had made him swear under no circumstances would he drink any of the liquor. Having his word on the matter, the she left the hut. The man waited several hours in excruciating pain, a day, a week, then two. After a month had gone by, he was weak and felt sure he was going to die. He reached for one of the bottles of brandy, thinking that before he passed away he would like one last drink. No sooner did the bottle touch his lips than his wife rushed in from the porch where she had been hiding for the past several weeks. "Ah ha!" she said, "I knew I couldn't trust you!"

Doubt and knowing are merely different sides of the same coin. In school, great emphasis is placed on knowing and exceedingly little is placed on constructive doubting. Socially speaking, doubters are not as warmly welcomed as other guests because they are constantly questioning or otherwise rocking the boat. Everyone expects the groom to answer with an affirmative unequivocal "I do." Imagine the chaos when the professional doubter answers, "I possibly do" or "under some conditions I might."

Fortunately, however, the whole world is not lost to the doubter, for there is one profession in which doubting is not only desired, but also essential. This field of endeavor is ***science***. Given the opportunity, a good scientist will doubt practically everything. A scientist of a few centuries back even doubted that he existed and only after several years of intensive thought, much to the gratification of his wife and children, was he was able to convince himself that he did exist after all.

But to the scientist doubting is not a game. The questions that scientists ask must be answered if a firm basis of knowledge is to be established. Regardless of the material scientists encounter or where they encounter it, they keep asking the same old questions: Who says so? Why? What are the data? Where is the proof? In fact, scientists ask the same questions so often that the questioning becomes second nature to them and is really a critical attitude scientists hold toward the subject matter of their fields. Scientific attitudes encountered in one discipline are quite similar to those encountered in another, because there are basic tenets to all scientific knowledge.

As scientists whose subject matter is behavior, behavior analysts have developed attitudes that they assume whenever they observe, hear about, read about, or otherwise witness behaving organisms. There are perhaps 10 or 12 scientific attitudes that are critically important to the behavior analysts. In this book, we will have an opportunity to deal with only six of these attitudes, but they are the six we feel are the most important to begin with. These attitudes (philosophical assumptions) are empiricism, determinism, parsimony, scientific manipulation, pragmatism, and selectionism.

Empiricism

Empiricism, or an empirical attitude, is one that dictates simply, "Let's look and see!" For many years it was thought that the nerves of the body were hollow tubes through which hot air called "animal spirits" puffed first here and there. Finally, someone cut open a corpse and found that things really weren't that way at all. Even modern times are not all that enlightened or free from rash conclusions made without bothering to look and see. Much of the writing passed off as being "scientific" is nothing more than speculations or assumptions on the part of the writer that were made without bothering to take a peek. Often it is not easy to directly observe the events scientists are interested in observing. Only recently have we been able to observe the surface of the moon at close enough range to accurately test some of our assumptions about it. The basic attitude of empiricism is one that must be affirmed regardless of our technical skill. We must always endeavor to look and see. Without this concerted effort, science becomes speculation, superstition, and hearsay.

Determinism

If it were truly a willy-nilly world, all scientists could close their laboratories, relax, and go their willy-nilly ways. Scientists persist in their work because they really and truly hold the attitude that the world, and the universe for that matter, is a lawful and orderly place. Nothing occurs without the presence of certain naturalistic conditions that collectively constitute a scientific cause. This is true whether the event be an avalanche, the performance of a worm as it crawls across the street, or the seemingly random verbalizations of a seriously disturbed mental patient. Like all scientists, behavior analysts assume that behavior is lawful and can ultimately be linked to causal factors. They spend their time observing behavior in order to identify these causal factors. Their hope, once the causal factors are identified, is to manipulate them and thus modify and control the behavior they observe. Inasmuch as they are successful, they can bring about appropriate behavior in the mental patient, rehabilitate the criminal, or bring up the grades of the college student on scholastic probation.

This is our most controversial assumption, **determinism**, the assumption of cause and effect; wherever there's an effect, an event, there's a cause, something caused it. Things don't just happen; something caused them to happen.

Tom: Not for me; what I do is not caused by some other cause. I choose to do what I do. I have free will.

Max: Well, if you choose what you do, then something caused you to make that choice. Like when it's cold, you choose to leave your coat on. The cold temperature caused you to leave it on.

Tom: But I don't have to. In fact, even though it's a little cold in here, I'm going to take my coat off right now, because I choose to of my own free will.

Max: And what caused you to take your coat off just now was that you've found it reinforcing to prove me wrong.

Sid: Most scientists are determinists; they believe that all things and events have a physical cause. But not all scientists believe that *all* things and events have a cause or at least not a physical, material cause; some scientists, sometimes, make exceptions, especially regarding human behavior. So if you're uncomfortable with determinism, don't let that chase you out of the science of behavior analysis, even if you think there may be a slight logical inconsistency floating around in the background.

Parsimony

To be parsimonious is to be stingy. All scientists, if they are worth their salt, are parsimonious in a very special way. They may lavish their children with good food, beautiful clothing, the newest and most modern toys, but when it comes to speculations or hypotheses about the causes of scientific phenomena, their stinginess itself is phenomenal. The scientific attitude of parsimony is so fundamental that it is often referred to as the "law of parsimony." In essence, this law says that a scientist should never hypothesize a complicated or more abstract scientific explanation unless all the simpler explanations have been experimentally ruled out. Throughout the history of science, the law has been violated repeatedly. As late as 1911, Dr. Charles Williams, a reputable London physician, vigorously defined the idea that mental illness was caused by demons who possessed the body of the patient. Today, psychologists are finding much more parsimonious causes for mental illness than demons or spirits.

Many behavior analysts have adopted an extremely parsimonious hypothesis that they feel may ultimately account for most of the behavior of organisms, both human and infrahuman. This hypothesis is that behavior is controlled by its consequences. In the simplest terms, this means that people and animals alike continue to do those things that reward or reinforce them and generally result in pleasant outcomes, and they tend not to persist in those acts that yield an unhappy ending. We feel that this is the simplest and most parsimonious hypothesis and is definitely an attitude we hold and would like to instill in our students.

The famous Stephen Hawking put it this way: *A good theory will describe a large range of phenomena on the basis of a few simple postulates and will make definite predictions that can be tested*.[6]

Experimentation (Scientific Manipulation)

A man who lived in a suburban dwelling area was surprised one evening to see his neighbor bow to the four winds, chant a strange melody, and dance around his front lawn beating a small drum. After witnessing the same ritual for over a month, the man became curious and decided to look into the matter.

> *Why do you go through this same ritual each evening?* the man asked his neighbor.
>
> *It keeps my house safe from tigers*, the neighbor replied.

Good grief! the man said, *Don't you know there isn't a tiger within a thousand miles of here?*

Yeah, the neighbor smiled, *Sure works, doesn't it!*

Like the neighbor, scientists sometimes make the mistake of assuming events are related in a cause-and-effect manner, when in fact their relationship is purely an accidental one. There is some evidence indicating that children born in the summer months have slightly higher I.Q.s than children born in other months. One might conclude that being born in the summer "causes" these children to be smarter than their peers. Actually, the association of higher I.Q.s and summer birth is an accidental one, which results because these children attend school at an earlier age (since schools start at the end of the summer) and are also slightly healthier than children born in other months.

If two things or events appear to be associated and you want to know if their association is happenstance or really a cause- and- effect one, the way to find out is to change or manipulate the occurrence of one event and see what happens to the other. This is called **experimentation** (scientific manipulation). And unless it is done, the scientist can never be sure what kind of relationship he or she is dealing with. If the scientific literature is read carefully, it is possible to find many mistakes of this kind. It is therefore important that scientists develop an attitude of scientific manipulation, that they do experiments and not fall into ritualistic pursuits, in order to keep their laboratories safe from tigers. In other words, the best way to determine cause-effect relations is to do experiments where you explicitly present a potential cause to see what, if any, effect it has.

Pragmatism

In truth, I've been going down the philosophical rabbit hole, in search of *pragmatism*. And maybe in its original sense it meant something like research should not consist of just sitting around talking and guessing and theorizing. Instead, research should end up dealing with the real, physical world. But often, behavior analysts and others use *pragmatic* to mean *useful*—if the results of your research don't end up with something we can actually use in the real world, then forget it.

Selectionism

The first level of ***selection*** is Darwin's ***natural selection***—biological selection. Some inherited characteristics lead to the survival of an individual who has those characteristics, like arms, legs, eyes, and ears (to put it very, very broadly). And the individual who has those characteristics is more likely to survive long enough to have children. And because those characteristics are inherited by the children, those children also more likely to survive. Furthermore, not only do the parents and children survive, but so do those characteristics that are being passed on from generation to generation, for example, characteristics like arms, legs, eyes, and ears (again, to put it very, very broadly). And not only that, but this natural selection may also result in the survival of the species that has those characteristics. Of course we're talking about the "natural" environment, not our "civilized" environment that can provide support for the survival of individuals who don't have all those characteristics. But Darwin's natural selection still applies to inherited characteristics in our complex, civilized, supportive environment, just not as completely as in a more "natural" environment. We call Darwin's biological selectionism ***phylogenic selection***—the selection of biological characteristics as a species, throughout the life of the species, as it evolves from generation to generation.

But we behavior analysts deal with Skinner's ***ontogenic selection***—the selection of behavior within the lifetime of an individual. And just as the characteristics of a species evolve because of selection by the environment, so do the characteristics of a response evolve because of selection by its consequences. If the response has reinforcing consequences, it will tend to survive; if it has punishing consequences, it will tend to die; and if it has no consequences, it will tend to extinguish, just as Darwin's species survive or extinguish.

And we have one more type of selectionism, ***social selection***—the selection of social behavior within the lifetime of a society. And just as the characteristics of a species and of a response evolve, so do the characteristics of a society evolve because of selection. For example, our language evolves as various expressions, words, and forms of words are selected, and in fact, some languages even become extinct, just like species and behaviors do. Social selection can be a result of individual influence, as when world-famous Arnold the Athlete announces on Facebook that the reason he's so great is that he smokes Mark's Marijuana. And social selection can be a result of organizational influence, as when Michigan's legislature passes the law that doin' recreational dope is absolutely cool. Or it can interact with biological selection, as when a religious group requires that all its members abstain from sexual intercourse and, as a result, the group becomes extinct.

Definition: CONCEPTS

Empiricism

- Knowledge comes from our senses.*

Determinism

- All events and all things
- have a cause.

Parsimony

- The use of no unnecessary concepts,
- principles,
- or assumptions.

Experimentation**

- The manipulation of events or conditions
- to evaluate their effects.

Pragmatism

- Research should have useful results.

Selectionism

- Characteristics of species, behavior, and societies are selected by their consequences.

QUESTIONS

1. Define *empiricism*.
2. Define *determinism*.
3. Define and give an example of *parsimony*.
4. Define *experimentation*.
5. Define *pragmatism*.
6. Define selectionism and give examples of
   a. Phylogenic selectionism
   b. Ontogenic selectionism
   c. Social selectionism

AND EVEN MORE CONCEPTS!

Here are a few concepts of a semi-technical, semi-obvious nature. Still it may help to discuss them, so they won't cause trouble later.

Behavior (B-1)

What is behavior? My students find the following rule helpful in answering that question:

Definition: GENERAL RULE

Dead-man test

- If a dead man **can** do it, it probably **isn't** behavior.

However, we find the **dead-man test***** most helpful in deciding what isn't behavior. Without it, we'd often end up analyzing the wrong thing—non-behavior. For example, for each chapter I ask my students to bring in original examples of the main concepts and principles of that chapter.**** And without careful use of the dead-man test, they often bring in examples like this: Mr. K. Lutz is a horrible dancer, so his wife reinforced his not dancing in order to protect her feet. And my dog used to be really loud, but then I reinforced his not barking, and now he's quiet. Of course both of these "behaviors" are things that dead men (or dogs) are capable of, so they fail the dead-man test; they're not the "behaviors" we should be analyzing.

So, dead men don't dance, and dead dogs don't bark. But this is just a rough, general rule; don't get bent out of shape if you find an exception now and then.

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* By ***senses*** we usually mean our sense of *sight*, *hearing*, *touch*, *taste*, and *smell*. But I hate to think that behavior-analyst work would depend on our sense of smell.

** **Experimentation** or **experiment** is a procedure. The scientific attitude (philosophical assumption) is that experimentation is the best way to find cause-effect relations, to find out what causes what.

*** A tip of the hat to the late Ogden Lindley for inventing this rule. I'm pretty sure Og would have been OK with it, if you prefer the *dead-**person*** test.

**** **Student Tip 3:** If you want to get skilled at doing your own behavior analyses, you may want to get our *Principles of Behavior Conceptual Homework*. So, once again, just go to DickMalott.com—also free. In fact, why don't you just go ahead and make DickMalott.com your home page, 'cause you know that's where the action is. No? Then how about just bookmarking it on your web browser?

However, apply the dead-man test only to behavior, not to reinforcers. For example, sometimes silence is the golden reinforcer, without a living soul around but you. So don't apply the dead-man test to the reinforcer of silence.

And here's a corollary to the dead-man test: If a dead man *can't* do it, then it probably *is* behavior. So, behavior is anything a dead man cannot do. Like scratch his nose. Talk. Smile. Cry. Think. Dream. Behavior may even be the firing of a neuron in the nervous system. Behavior is anything an animal (including the human animal) does.

And here's a more common definition of behavior:

Definition: CONCEPT

Behavior

- A muscular, glandular, or neuroelectrical activity.

So a rat pressing a lever or you turning your steering wheel are both muscle activities, and both are obviously behavior. Your adrenal gland releasing adrenalin into your system during a particularly scary scene in a movie is a glandular activity, so it's also a type of behavior. However, I make greater use of the dead-man test than the more formal definition of behavior because I consider all of the following to be behavior: thinking, dreaming, closing your eyes and seeing the image of your boyfriend or girlfriend, and hearing tunes when your iPod is shut off. And I'm not sure those activities involve muscle or glandular activities, though they do involve neuroelectrical activity.

Furthermore, I suspect reinforcers can increase the frequency of those activities, so that's even more reason to consider them behavior. And yes, not only can environmental events, such as the presentation of reinforcers, influence or control the obvious activities of the muscles; similar environmental events can also influence or control glandular and neuroelectrical activities. And even further out, environmental events, such as the presentation of reinforcers, might possibly also influence or control biological processes like digestive activity, so we might even be able to consider some of those processes to be behavior—not sure.

Here's something that confuses many students: *Behavior analysts use response and behavior almost interchangeably*. So we might say Eric's tantruming is **behavior**, and we might say it's a **response**. But saying Eric's tantruming is a response doesn't necessarily mean it's a response to some stimulus, like being at school. He may just be tantruming because in the past, that behavior has been reinforced with attention, even when he wasn't at school. In other words, we don't necessarily restrict response to mean a reaction to something, like a reaction to being at school. In other words, **behavior = response**.*

And here are some other words that mean more or less the same as behavior or response: act, action, movement, and reaction. When we speak of behavior, we don't restrict its meaning to "comportment" or "manners." For example, our technical use of the term wouldn't include "I want you to be on good behavior" or "she was ill-behaved." This means that *Principles of Behavior* is not about how to avoid getting a scolding from Mommy for being rude or for talking with your mouth full.

Note: Some of this discussion of behavior, the dead-man test, dreaming, and so on is a little on the edge, so your teacher might not agree with it all, and you'll probably hear about it, if that's the case.

Behavior Analysis

Behavior analysis is the study of the behavior of human beings and other animals. And that's what this book is about.

Definition: CONCEPT

Behavior analysis

- The study of the principles of behavior.

Behavior Analyst (A-4)

If you know what behavior analysis is, the following shouldn't come as a major shock: *A* ***behavior analyst*** *is a person who studies or explicitly uses the principles of behavior.*

Generally, behavior analysts are

- **experimental behavior analysts**, doing research, often with animals, studying the basic principles of behavior.

* Often, behaviorists use ***behavior*** to refer to a larger set of responses sharing certain physical characteristics or functions and ***response*** to refer to a specific instance of behavior, like the **behavior** of writing in general and the **response** of writing a specific word.

- Or they are **theoretical behavior analysts**, doing paper-and-pencil, keyboard, or head work to understand the principles and concepts of behavior analysis, how those principles and concepts relate to each other, and how those principles and concepts relate to the rest of the world.
- Or they are **applied behavior analysts**, doing research, usually with human beings, studying applications of the principles of behavior to socially significant problems.
- Or they are **service providers (professional practitioners, a.k.a. science-based practitioners)**, using the principles of behavior to solve socially significant problems.
- And, of course, some of us behavior analysts are various combinations of the preceding.

And for a little summary:

Definition: CONCEPTS

Experimental analysis of behavior

- The use of experimental research to discover
- the effects of environmental variables on behavior,
- resulting in the basic principles of behavior.

Applied behavior analysis

- The use of experimental research to discover
- ways to use the basic principles of behavior
- to solve socially significant problems.

Professional practice guided by the science of behavior analysis

- The use of the basic and applied principles of behavior
- to solve socially significant problems.

Many behavior analysts are psychologists. Many are not. They might be special ed teachers, social workers, nurses, or managers of staff performance in businesses or other organizations—anyone explicitly using the principles of behavior in dealing with actual behavior.

Behavior analysts often work as performance managers. Performance managers include all sorts of people trained in the principles of behavior—teachers, parents, coaches, supervisors, clinicians, social workers, nurses, business managers, animal trainers, and those who manage their own personal performance (though managing your own behavior is no easy trick[7]). Of course, most teachers, parents, and so forth are not performance managers (as we use the term) because they are not knowledgeably using the principles of behavior.

We slightly prefer performance manager or behavior manager to behavior modifier. Why? Because a manager may have the goal of supporting an already satisfactory performance with no need to modify it. Said another way, if it ain't broke, don't fix it—don't modify it. Behavioral engineer is another acceptable term that means about the same thing—though for some people, it implies that we're working with machines and not people or, worse yet, treating people as machines.

Whatever label we use, remember that we're talking about using the principles of behavior, like the principle of reinforcement, to manage performance. We're not talking about brain surgery or drugs when we speak of managing performance or modifying behavior.

You might consider the behavior therapist to be a behavior analyst who specializes in working with abnormal behavior, traditionally the kind seen in a psychiatric hospital or mental health clinic. Behavior therapists are often clinical psychologists or social workers, though not always. Normally you wouldn't apply the term behavior therapist to a behavior analyst who sets up reinforcement procedures to improve productivity in a factory.

Repertoire

Your **repertoire** is your set of skills. If you've gotten this far in the English version of this book, then your repertoire must include reading English. Or else, you're quickly becoming an expert on Google Translate. By the time you've finished this book, we hope your repertoire will also contain the use of behavior analysis. Dancing may be in your repertoire. Perhaps playing baseball, or at least talking about playing baseball, is also in your repertoire. Or if you can't throw a baseball, can you at least throw a tantrum, like Eric? Is tantruming part of your repertoire?

The reinforcement of novel behavior puts that behavior in your repertoire—you learn it. Reinforcement of established behavior maintains that behavior in your repertoire. You learn Spanish, and then you practice it or else you lose it. You learn behavior analysis, and then you practice it or lose it from your repertoire. "Use it or lose it" is a good folk principle of behavior.

But: repertoire is not a thing. You don't have a repertoire that holds all your tricks. It's just a way of speaking, a risky convenience. Your repertoire is just the total collection of things you can do. It's not a warehouse from which you retrieve your stored tricks.

Definition: CONCEPT

Repertoire

- A set of skills.

A repertoire is what a person or animal can do.

If, by the end of this book, you can pronounce repertoire correctly and with grace, you'll be ahead of most people. *Reper* is no big problem. You don't get much credit for that part. Except you pronounce *re* as in *represent*, not as in *repeat*. So try it: *reper*. Remember, don't say it like *reaper*, as in the grim *reaper*. The hard part: *toire*. Like *twar*, as in *car*, not like as in *war*. Now say the whole thing: *repertoire*. Not bad; but keep practicing.

Behavioral Intervention

By behavioral intervention, we mean the use of a behavioral procedure or program. We don't mean a military intervention. For example, Mae plans to intervene in Eric's classroom tantruming. But don't think we use behavioral interventions just to stop or decrease behavior. Mae might also use a behavioral intervention to increase the amount of time Eric studies. (We don't want to make such a big deal of behavioral intervention as to require you to memorize a formal definition. We just want you to tune in.)

We prefer to stay neutral and say the behavior analyst intervenes on behavioral or performance problems. We tend not to talk of "treating" behavior problems, because we don't want to imply a medical model (we'll get to the *medical model* in a few minutes).

QUESTION

1. Define and give an example of

   a. *Dead-man test*
   b. *Behavior*
      i. Muscular
      ii. Glandular
      iii. Neuroelectrical
   c. *Behavior analysis*
   d. *Experimental analysis of behavior*
   e. *Applied behavior analysis*
   f. *Professional practice guided by the science of behavior analysis*
   g. *Repertoire*

Compare and Contrast

PSYCHIATRY VS. PSYCHOLOGY

Who's the most famous psychologist in the world? Freud. Right, Freud (1856–1939). What's his first name? Ah, Sigmund? You've got it. Except Freud wasn't a psychologist. He was a physician whose specialty was neurology. Today we would call him a psychiatrist, not a psychologist. What's the difference? Psychiatry is a specialty in medicine, just like surgery. A psychiatrist must have an MD degree. A psychologist must have a PhD, an MA, or a BA (BS) degree, depending on the licensing requirements in the state where the psychologist works. Even psychologists who specialize in behavioral medicine are PhDs, not MDs. So psychiatry is a medical specialty, and psychology is a branch of the arts and sciences.

We've seen how psychiatry and psychology contrast. How are they comparable? Both deal with the understanding and improvement of behavior or the mind, depending on whether you're a behaviorist or a mentalist.

OK, if Freud isn't the most famous psychologist in the world, then who is? Gets tougher, doesn't it? Pavlov? Yes, probably Pavlov (1849–1936), for the average person, the layperson, the non-psychologist. He did the famous conditioning experiments with salivating dogs. But Ivan Pavlov also wasn't a psychologist; he was a physiologist.

Then, who's the most famous *real* psychologist according to other psychologists (determined by a poll of the chairs of U.S. psychology departments), not necessarily according to *People* magazine? The answer: B. F. Skinner (1904–1990). Incidentally, Skinner even beat out Freud in a count of the number of times his name was recently cited in scholarly journals—again, not necessarily in *People* magazine.

Skinner started out working with animals as Pavlov had, except Skinner worked with lever-pressing rats and disk-pecking pigeons. But the influence of his work has spread a long way from the simple behavior of the rats and pigeons. He started what we now call **behavior analysis**, an approach to psychology that forms a basis for understanding all human behavior, the approach we present in this book.

QUESTIONS

1. Compare and contrast psychiatry and psychology.
2. Who is the most famous real psychologist in the world?

Compare and Contrast

PSYCHOANALYSIS VS. BEHAVIOR ANALYSIS

Behavior analysis is a behavioristic approach to the study and improvement of behavior. One of its central notions is *past consequences cause current behavior*.

Psychoanalysis is a mentalistic approach to the study and improvement of behavior and the mind. One of its central notions is *past experiences cause current behavior by channeling unconscious mental forces*.

Behavior analysis and psychoanalysis are similar in that both argue that experience causes current behavior. They differ in that behavior analysis points to the past consequences of behavior as the crucial cause, and psychoanalysis points to unconscious mental forces (influenced by experience) as the crucial cause.

Freud is the father of psychoanalysis. Skinner is the father of behavior analysis.

A basic principle of behavior analysis:
The consequences of past behavior cause current behavior.
A basic principle of psychoanalysis:
Past experience causes current behavior by channeling unconscious mental forces.

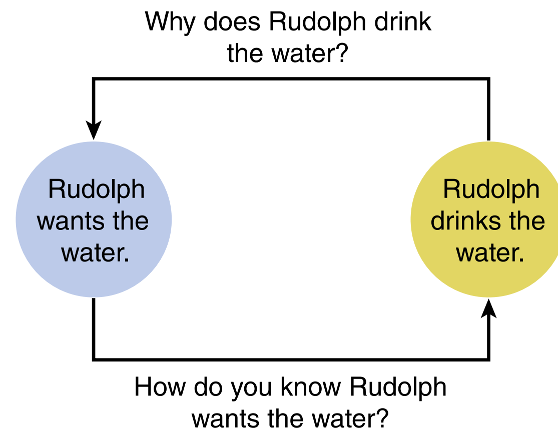
QUESTION

1. In simple terms, compare and contrast behavior analysis and psychoanalysis.

General Rule

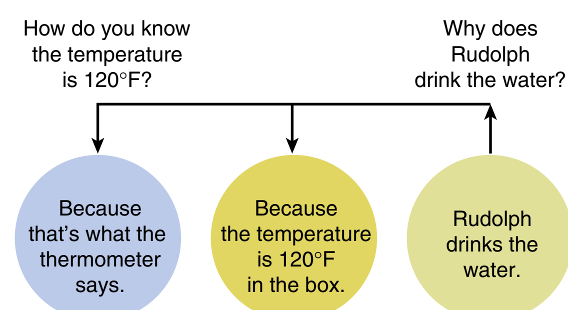
AVOID CIRCULAR REASONING

Here's another way to look at the problem. Why does Rudolph drink the water? Because he wants it. How do you know he wants the water? Because he drinks it. Why does he drink the water? Because he wants it. How do you . . . and around and around in a pattern of circular reasoning resembling Rudolph chasing his own tail.



In other words, this attempt at an explanation looks like an explanation, but it ain't. It looks like we've added some new information, when we say *Rudolph wants the water*. But that only gives us a false sense of understanding. To say *Rudolph wants the water* doesn't tell us anything we don't already know; it just tells us that Rudolph is drinking the water. That's circular reasoning.

What would be a noncircular explanation? Rudolph drinks the water because the temperature in his box is 120°F. That's new information. How do you know the temperature is 120°F? That's what the thermometer reads.



So whenever you're talkin' technical, don't use *want*, because it probably means you're caught in the horrible trap of circular reasoning.

Circular reasoning occurs when the only proof you have is the occurrence of the thing you're trying to prove.

Avoid circular reasoning!

QUESTIONS

1. What's the name for the kind of reasoning involved with terms like *want*?
2. Diagram an example of circular reasoning.

CIRCULAR REASONING AND THE ERROR OF REIFICATION

Here's another example of circular reasoning: *Dr. Thud, why does Jenny act so strangely* (**a behavior**)? *Easy, because she has a mental illness* (**a thing**). *And, Dr. Thud, how do you know Jenny has a mental illness? Because she acts so strangely. But, Dr. Thud, why does Jenny act so strangely? Because she has a . . .* Well, you get it. What Dr. Thud has done is invent a thing (the mental illness) to explain a behavior (acting strangely). And the proof of the existence of that invented thing is the behavior that invented thing was supposed to explain. All Dr. Thud has really done is call the behavior (acting strangely) a thing (mental illness). He has invented this mental illness. It's what Skinner calls an ***explanatory fiction***. (An ***explanatory fiction*** is just something someone has invented to explain an event they're having trouble explaining, like *What's that creepy sound? Maybe it's a ghost!* Here the ghost is the explanatory fiction, in case you hadn't guessed it.) But more technically, an ***explanatory fiction*** is a ***reification***; and Dr. Thud has committed the **error of reification**.

Definition: CONCEPT

Error of reification

- To call an invented explanation a thing.

And we'd justify our inferred mental illness by pointing to the behavior as the symptom that proves the existence of the underlying mental illness.

The major problem with psychology may be the high frequency with which psychologists and psychiatrists invent explanatory fictions for behavioral (psychological) problems. And they always seem to commit the **error of reification** when they invent these explanations.

Usually, when you hear professional psychologists use the term *personality*, they are committing the serious error of reification. Why does she act in a dysfunctional manner? Because she has a dysfunctional personality. Why does he get drunk and drive fast without his seat belt? Because he has a thrill-seeking personality or a death wish.

And psychologists have invented a major industry (intellectual and personality testing) based on reifications, that is, explanatory fictions. Why does he act in such a dumb manner (activity)? Because he has a low IQ (inferred thing).

QUESTIONS

1. *The error of reification*—define it and give an example.
2. Show how the error of reification is an example of circular reasoning.

Concept

MEDICAL-MODEL MYTH

We behavior analysts are always battling the **medical-model myth**. Here's how traditional psychologists apply the medical model to psychology: They say an undesirable behavior is a symptom. And they say the symptom suggests some underlying psychological disease, just as a fever might suggest an infection. So, according to the medical model, Eric's tantrums suggest a more profound underlying psychological problem, perhaps insecurity. We behavior analysts don't trust such interpretations. Instead, we suspect Eric's tantrums are learned behavior reinforced by their immediate consequences—for example, his parents' attention. Behavioral research shows that problem behavior is usually not a symptom of the big deal; it *is* the big deal.

What you see is what you get.
Or maybe what you see is what he's got.

This doesn't mean behavioral problems don't sometimes result from underlying biological problems—for example, brain injury or Down syndrome. Still, traditional psychologists misuse the medical model by guessing about or inventing underlying psychological causes for observable behavior. Then these psychologists end up caring more about their invented causes than about the actual problem—the behavior.

Definition: CONCEPT

Medical-model myth

- An erroneous view that human problem behavior is a mere symptom of
- an underlying psychological condition.

The medical model suggests that the behavior is of little importance in its own right. We behavior analysts disagree. (By the way, we're using *model* more or less to mean a representation. In the present context, a medical disease would be a model of a psychological problem, somewhat as a toy airplane would be a model of a real one.)

Understand that traditional psychologists who use a medical model don't mean that taking medicine will cure the problem. Instead, they are just guessing that some hidden, deeper, underlying psychological problem causes the obvious behavior problem. The behavior problem is just a symptom of the underlying psychological problem. Behavior analysts think most uses of the medical model in psychology are wrong; it's generally a model to avoid.

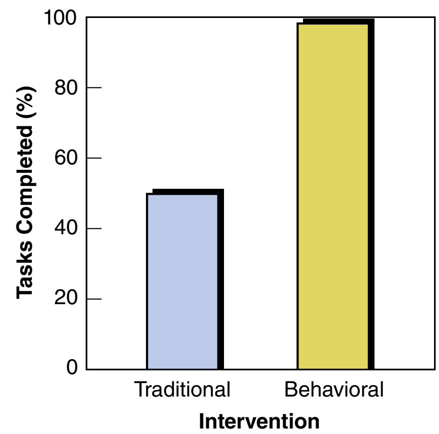


Figure 5.1 Assistants' Task Completion

QUESTION

1. *Medical-model myth*—define it and give an example.

Examples

MEDICAL-MODEL MYTH

Students say the medical model is a tough concept, so let's look at other examples.

Passive Aggression

A professor once complained about a graduate assistant he was working with. He said, "That guy is passive-aggressive."

"Why do you say that?" I asked.

The professor replied, "Well, he agrees to do tasks I ask him to do. But then he doesn't do them. He's passively aggressing against me because he doesn't like me."

Here's an alternate, more behavioral interpretation: The professor's approval is a powerful reinforcer, and it certainly reinforces the assistant's agreeing to do the tasks. But without clear-cut deadlines, even that powerful reinforcer will fail to control the assistant's behavior—that old devil, procrastination, will take over. The spirit is willing, but the flesh is weak.

Now, this isn't just a meaningless academic debate between two professors. The medical model would have us try to correct the hypothesized, deep, underlying problem; this particular medical model would have us try to convince the assistant that the professor is really a good guy and not someone he should try to hurt.

We've had more success with a behavioral approach: For her doctoral dissertation, Barb Fulton[8] did an experiment, the results of which support a behavioral approach. She measured her assistants' task completion during baseline in which she used a traditional approach of assigning tasks orally and not following up when the assistants didn't complete the tasks. While intervening, she held weekly meetings. There she assigned tasks in writing, gave due dates, and checked that they'd completed the tasks assigned the previous week. Her results are shown in Figure 5.1.*

If you look at the graph of Barb's data, you see there were two approaches—the traditional and the behavioral. Now what results did the traditional approach produce? Note that the bar for the traditional approach goes up to about 50% on the vertical axis. So assistants completed about 50% of their tasks when Barb used the traditional approach. In the same way, you can see that they completed almost 100% of their tasks with the behavioral approach. In other words, Barb's behavioral approach was almost twice as effective as the traditional approach, and she didn't have to worry about a medical-model interpretation that would suggest her assistants were being passive aggressive.

Fear of Success and Fear of Failure

Consider the woman who often fails to get her homework done in time to hand it in. Some traditional personality theorists

* Often, simple bar graphs like this tell the story much more clearly than do complex graphs. However, we'll give you some training with complex graphs as we go along.

would use the medical model to say her failure to hand in her homework is a mere symptom of the underlying cause—an unconscious fear of success. The woman fears that she will lose her feminine charm if she becomes a successful scholar. The guys won't like her. She won't get that Prince Charming her parents programmed her to pursue. Or they might say she's suffering from fear of failure, so she just doesn't complete her homework; that way she won't have tried and failed.[9]

Here's an alternate, a behavioral view: Doing almost anything else is more reinforcing and less effortful than doing her homework. So she does everything but her homework.

Most people use the medical model when they explain human behavior. But usually a simpler, behavioral interpretation is more accurate and will help us intervene with better results.

Other Examples

Why do people smoke cigarettes? Because they have an underlying death wish? Give us a break. How about because smoking has reinforcing chemical effects, and it's easiest for the tobacco companies to get you hooked when you're a teenager, which is when you're more susceptible to the addictive properties of nicotine?

Why does Eric have temper tantrums? Because he has low self-esteem? So much time has been wasted in the futile attempt to improve people's performance by improving their self-esteem that it's a human tragedy, thanks to this misuse of the medical model. Eric has temper tantrums because they are reinforced with attention.

Why does "schizophrenic girl" act one way sometimes and another way other times? Because she has a split personality? No, because sometimes acting one way produces reinforcers and other times acting another way produces the reinforcers.

Prescience

As the science of medicine was developing, it had to battle a superstitious model: Why is that person ill? Because she has evil spirits inside her. How shall we cure her illness? Exorcise the evil spirits. Today the practice of medicine based on science has largely replaced the practice based on superstition.

Psychology has the same problem. As the science of psychology develops, it has to do battle with a misapplied medical model: Why is the person acting inappropriately? Because she has a mental illness inside her. How shall we help her act appropriately? Cure her mental illness. Today the practice of psychology based on science is struggling to replace the practice based on the misapplied medical model, just like medicine once had to replace medical practice based on a superstitious model.

Root Causes

Does the medical model address the root causes of psychological problems and the behavioral model address just the superficial symptoms of the problems? No. The medical model invents fictional cause, and the behavioral model addresses actual cause. It's just that the actual causes of our behavior are often much simpler (in some senses) than a psychodynamic (type of medical model) view of psychology would lead us to think. In other words, we don't smoke cigarettes because we are fixated on our genital stage of infantile development; instead, we smoke because smoking behavior is reinforced by the outcome. Granted, figuring out just what those reinforcers are isn't always simple.

QUESTION

1. Medical model—give examples of how it differs from the behavioral view.

CIRCULAR REASONING AND THE MEDICAL-MODEL MYTH

It turns out that what's wrong with most of the medical-model applications in psychology is that they're based on circular reasoning.

Why does Eric tantrum? Because he's insecure (underlying psychological condition). How do you know he's insecure? Because he tantrums (a symptom). Circular reasoning.

Why is there this behavior problem? According to the medical model, it's because of an underlying psychological problem. How do you know there's this underlying psychological problem? Because there's the behavior problem that is a symptom of that underlying psychological problem. Circular reasoning.

Why doesn't the grad assistant do the tasks he's agreed to do? Because of his underlying psychological problem of passive aggressiveness. How do you know he's passive-aggressive? Because his failure to do what he agreed to do is a symptom of his passive aggressiveness. Circular reasoning.*

* I think all instances of the medical-model myth are instances of circular reasoning, but not all instances of circular reasoning are instances of the medical-model myth. For example, saying *Rudolph*

QUESTION

1. How is the wrong use of the medical model an example of circular reasoning? Please give an example.

THE SEVEN DIMENSIONS OF APPLIED BEHAVIOR ANALYSIS (A-5)

We behavior analysts consider Skinner's *Behavior of Organisms* (1938)[10]* to be our founding text. But most behavior analysts have not actually read it. And we consider Baer, Wolf, and Risley's *Some Current Dimensions of Applied Behavior Analysis* (1968)[11] to be the founding text of applied behavior analysis. Most behavior analysts not only have read it but also have been required to memorize it! So we're going to break it down for you, here.

Applied (A-4, F-3)

First, they describe the difference between **applied** and **basic behavior-analytic research**. For example, with Rudolph in Skinner's box, we don't really give a damn whether Rudy presses the lever. It's not going to make him or anyone else any happier; it doesn't matter, except to the basic researchers (and you students in our Intro Rat Lab, of course). The basic researchers care, because Rudy's pressing or not pressing the lever is crucial to discovering and verifying the principles of behavior. And that's what basic researchers are searching for and trying to understand—the principles of behavior.

But **applied behavior-analysis (ABA) researchers** are searching for solutions to society's problems, whether that's to get the kid with autism to stop banging his head, or you to stop biting your nails, or you to get an *A* in Intro Behavior Analysis, or your doggy, Spot, to shake your hand and also to stop viciously fighting with other doggies, or all of us to work toward ending poverty. Applied behavior-analysis researchers are discovering how to use the basic researcher's principles of behavior to improve the well-being of human beings and other animals. And that's all so cool it makes me really happy, and it should make you at least a little happy too.

drinks water because he wants it is circular but not an example of the medical-model myth. Although we don't explicitly say so in our definition, the medical-model myth probably best applies to inappropriate behavior or some sort of assumed inappropriate cause.

* The Baer, Wolf, and Risley article was only addressing applied behavior-analysis research, but we think it's important to also consider the extent to which it's relevant to basic behavior-analysis research and to science-based behavior-analysis practice.

And then there's the **science-based practitioners**. Their main goal is not to discover how to use the principles of applied behavior analysis; it's to actually use those principles to *improve* the *well-being* of as many human beings and other animals as is possible.

Behavioral (C-2)

And the **dependent variable**, the thing we measure, is **behavior**, whether we're basic or applied researchers or science-based practitioners. A basic behavior-analysis researcher might measure the frequency or force of Rudy's lever press, but probably not his blood pressure. And the same with Ronnie the runner; the applied behavior-analysis researcher might measure her speed and duration as the primary dependent variables, not her pulse rate, though that might be a secondary dependent variable. And the ABA researcher might measure the number of days per week that Ronnie runs. But, more importantly, we behavior analysts measure the behavior, not what people say about their behavior—what they actually do, not what they say they do. Now that tends to be truer of applied behavior-analysis researchers than science-based practitioners. For example, if an ABA researcher wants to study the effects of an incentive on your behavior of reading *Principles of Behavior*, they might require that they be able to observe and record your actual behavior, in order for them to give you a reinforcer contingent on your reading *PoB*. They might record the amount of time you simply look at and turn the pages; or, if they're getting really picky, they might insist that you read *PoB* out loud!

And that's one of the main ways behavior analysts differ from many more traditional psychologists. When possible, science-based practitioners usually try to actually observe and directly measure the behavior of interest; they don't just sit down and chat with the person about their problem behaviors and feelings and then make some suggestions, followed by weekly 1-hour meetings. If we can't directly observe the behavior, we'll want to see a product of their behavior, like a daily or weekly graph of their weight, if they're having trouble with dieting. And some of my students have volunteered to take an iPhoto of their weighing themselves or to FaceTime from the gym every morning, as proof of their behavior for their fellow student who's acting as their performance manager. And though less reliable, sometimes a person will simply record and graph their behavior or behavior product (e.g., their weight) and then show their weekly updated graph to their performance manager.

And in organizational behavior management, we behavior analysts often measure not only behavior but also a permanent product of that behavior. And sometimes, we only measure the permanent product and not the behavior, like the number of do-hickeys manufactured per day and not the actual behavior of that manufacturing.

And, in Chapter 4, they measured Dawn's carbon monoxide levels (not behavior), to sort of confirm her self-report of her cigarette-smoking behavior. In other words, when we applied behavior analysts can't directly measure the behavior, we may have to go with self-reports and a product of the behavior (carbon monoxide level)—not too bad.

In any event, the evidence is fairly strong that simply doing traditional talk therapy or counseling is not very effective, no matter how good it feels at the moment.

But we applied behavior analysts are also quite concerned about the person's feeling: Applied behavior analysts and science-based practitioners also ask, *How'd you feel about it? How'd you like it?* In other words, we not only want a direct measure of your behavior, but we also often want to know how you liked the behavioral procedure we used and the results. In the case of developing/writing/rewriting our book, *PoB*, Kelly and I not only asked our students to read each chapter and measure whether they read it by giving them a quiz over that chapter, but we also asked them how they liked it and how difficult it was, and then we rewrote each chapter accordingly. Behavior analysts call asking those how'd-you-like-it questions the measurement of the **social validity** of their procedures. For example, we don't want to develop a procedure that may help someone, but when it's all said and done, that someone hates our procedure and us; we don't want to develop a procedure that's not **socially valid**. And we also ask, *How'd you feel about the results?*

Actually, it gets much more complicated. What we've said is OK for **methodological behaviorists**, behaviorists who believe that true behaviorists should only deal with observable behavior, behavior that two or more people can observe and agree on what've observed, that is, can get **interobserver agreement** reliability measures on. But we **radical behaviorists** believe that thinking, that talking to yourself, is also behavior, just like Rudolph's lever pressing is. Thinking is behavior that occurs because it's reinforced. Of course, we radical behaviorists haven't been able to make too much progress on this private thinking behavior that only the thinker can observe, and even that thinker often fails to observe what he or she's thinking. But at least we're thinking about it.

(Oh yes, and one of my Facebook friends asked me what reinforces thinking. Many different things: the solution to a problem, when you're thinking through a problem. Humor, when you're thinking about something funny. A feeling of love, when you're thinking about your boyfriend or girlfriend, or even one of your children. Lots of reinforcers for thinking. Even the feeling of sadness, like when you think, *Nobody likes me, everybody hates me, I guess I should go eat worms*. Yeah, feeling sad can also be reinforcing, or else we wouldn't watch tearjerker flicks. Yes, we human beings are pretty weird; but don't get me wrong, some of my best friends are human beings.)

In truth, almost all of what basic and applied behavior-analysis researchers study is observable behavior. But we science-based practitioners sometimes need to drift a little further away from that when we're trying to help verbal human beings.

Analytic (D-5)

Here, by **analytic** we mean scientifically experimental, we mean changing the value of our **independent variable (IV)** to see if our **dependent variable (DV)** also changes. In basic research, Rudolph's just hanging out in the Skinner box an hour a day for several days, and he almost never presses that lever. But when we make a drop of water contingent on each lever press, he gradually starts pressing the lever more and more often, and when we stop the contingent drops of water, his lever presses gradually decrease. If we do that enough times, we become pretty convinced that reinforcement is causing the lever presses. And what kind of research design is that? Ah, Chapter 4? Ah, a **reversal** experimental design: You bounce back and forth between two values of the IV to see if the DV also bounces back and forth. And if it does, then you conclude that your IV is causing the values of the DV. And usually, you bounce back and forth between a zero value and a substantial value of your IV.

But suppose you're attempting to train a "new" behavior, like Sid was doing in Chapter 4, when he was using **behavioral skills training (BST)** to teach his graduating seniors how to do good interviews. Our reversal design isn't going to do the trick there; Sid can't unteach those skills. But, as we saw, he used a **multiple-baseline** experimental design. He couldn't bounce back and forth three times, between a zero value and a 100% value of his independent variable, BST, so instead he went from zero to 100% with his IV on three different behaviors. He used BST to teach three different interviewing skills. And, in all three cases, the DV went from a very low value to a high value, when he applied his IV, his BST. So we feel fairly safe in saying that his BST was the cause of his student's improved performance.

And our confidence that we've actually demonstrated a cause-effect relationship is a function of the number of times we repeat, or as we scientists like to say, replicate, our IV => DV relationship, the number of times we do reversals with Rudolph and the number of Rudolphs we do it with, and the number of different skills Sid teaches his students and the number of different students he teaches. As the numbers increase, we become increasingly confident that our changing the value of our IVs does cause the value of our DVs to change. And that's analytical science.

Let me add that this is somewhat less relevant for science-based practitioners, but not completely irrelevant. Their main goal is to help their clients, by basing their practice on the research the basic and applied behavior-analytic researchers have proven effective, not to discover and prove more principles and procedures themselves. Nonetheless, they do want to make sure that their practice is helping their clients. Therefore, practitioners often collect baseline data for a few days to assess the level of the problem, and then they implement their behavioral procedure to help their client and measure their client's relevant behavior to assess whether their procedure is actually helping. So, science-based practitioners, as well as basic and applied behavior-analytic researchers, are analytical.

Technological

An applied behavior-analysis procedure is **technological**, if we've described it in enough detail that the person who's applying it knows how to do that procedure. Remember Bruce Black trying to reduce the boys' threatening each other in the school shop (Chapter 2). Mae couldn't just tell Bruce to use negative punishment, even if he were a Board Certified Behavior Analyst, a BCBA. And in reality, Bruce probably would have to be a BCBA, or the equivalent, to successfully use such a complex procedure. Mae would have to describe, in writing, all the details, so that Bruce would have a fighting chance of getting the boys to stop threatening and fighting. For example, he'd probably need to do a reinforcer assessment, for each individual boy, to make sure the points that they could lose were really reinforcers, that is, could be exchanged for things that were, themselves, really reinforcers. And there would need to be details about how Bruce should handle it, when one of the boys threatened him if he removed points for that boy's threatening someone else. She'd need a lot of what-to-do and how-to-do-it details for Bruce to effectively use that negative punishment procedure, in other words, for it to be technological.

For applied behavior-analysis researchers, a procedure needs to be technological so that another researcher can replicate (repeat) the original research. But the applied science-based practitioner may need to do more than that; the practitioner may need to train someone else to use the procedure, someone who's not a behavior analyst, someone like a parent or a teacher.

True confessions; There's one common and important procedure that's too hard to describe in enough detail for it to really be considered technological—it's called ***shaping***, for example, when you work with Rudolph in the Skinner box and you want to train him to press the lever. Well, if you wait for him to press the lever before you reinforce any response, you may wait forever. Eventually, Rudolph will just wander over to a corner of the Skinner box and fall asleep, and you'll just wander over to a corner of the rat lab and fall asleep. So you have to gradually ***shape*** his lever presses, like reinforce his looking at the lever, then moving toward it, then touching it, then a little press, then more and more until he's really whacking it. Also, as you move along, you may have to raise and lower what you require of him.

And as an applied behavior analyst, you'll use shaping, for example, when you're teaching a kid to make speech sounds; but it's really subtle. In fact, when we have more than one behavior technician teaching a child to make speech sounds, we'll have one behavior tech shaping the *ahh* sound and another shaping the *mmm* sound. Why? Because it's too hard for each tech to know just how far the other tech has progressed with a particular speech sound, if they watched the other tech's previous shaping session. In other words, shaping is often more an art than a technology. But we practitioners try to be as technological as we can. (By the way, you'll get into *shaping* big time, in Chapter 11.)

Conceptually Systematic

But our procedures should be more than technological, more than a careful description of all the crucial details. We should show how our procedures are based on the principles and concepts of both basic and applied behavior analysis. And this is for a couple reasons: It will be easier for people to understand and remember our procedures if they make sense in terms of our principles and concepts. And it will also be easier for us to modify our procedures, in order to apply them to other situations, and it will be easier to come up with new procedures, if they are related to the relevant principles and concepts. In other words, our procedures shouldn't be just a bag of tricks; instead, they should make sense in terms of our understanding of behavior analysis—they should be conceptually solid, **conceptually systematic**.

Effective

Our procedures should also be **effective** enough that they produce a socially significant change, especially if we are applied behavior-analyst researchers or science-based practitioners. If we've only managed to get our kid to reliably make two different sounds, that may be scientifically interesting, but our procedure isn't effective enough to improve the quality of his life. At least we need to get his vocal behavior to the place where he can say some word approximations that others can understand, for example as a request for specific reinforcers.

Generality

We're often able to teach children how to make speech sounds and eventually to say words. But they must also be able do it away from the table where we're teaching them and with people other than us. And they need to be able to continue saying those words after we've stopped teaching them. Often, we do this by explicitly training the children to say the words, in other places and with other people, when we're not even around. Usually not too hard. But our goal is for the words the children say to be functional, for example for them to be able to ask for their reinforcers. And it's always a thrill for us when a child's starts making requests not only in our autism center but also at home with Mommy and Daddy. (Oh yes, then our next step is to make sure they aren't making those requests too often, aren't constantly nagging. We often must help them learn to accept *not now* as the answer!)

In Sum

A good applied behavior-analysis procedure is not only **applied**, **behavioral**, and **analytic**, but also **technological**, **conceptually systematic**, **effective**, and it produces behavior changes that are **general**.

Definition: GENERAL RULE

Seven Dimensions of Applied Behavior Analysis

- Applied
- Behavioral
- Analytic
- Technological
- Conceptually systematic
- Effective
- General

QUESTIONS

1. Describe each of the seven dimensions of applied behavior analysis.
2. Why is each dimension important for behavior analysts?

Notes

1 Watson, J. B. (1958 [1924]). *Behaviorism* (Revised ed., p. 82). Chicago: University of Chicago Press. OCLC 3124756.

2 Watson, J. B. (1930). *Behaviorism* (Revised ed., p. 82). Chicago: University of Chicago Press.

3 Watson, J. B. (1913). Psychology as the behaviorist views it. *Psychological Review*, *20*. And if you want to dig a lot deeper into Watson's battle with eugenics-based racism, I highly recommend Rakos, R. (1913). *John B. Watson's 1913 behaviorist manifesto, setting the stage for behaviorism's social-action legacy*. Retrieved from http://rmac-mx.org/john-b-watsons-1913-behaviorist-manifestosetting-the-stage-for-behaviorisms-social-action-legacy/

4 By the way, I think what Skinner meant by *radical* was *thoroughgoing*. In other words, his radical behaviorism was so thoroughgoing that it not only applied to Rudy's lever pressing, but also to your thinking. However, others often take the *radical* in *radical behaviorism* to mean extreme or iconoclastic. And for more on *radical*, you can check out Schneider, S. M., & Morris, E. K. (1987). A history of the term radical behaviorism: From Watson to Skinner. *Behavior Analyst*, *10*(1), 27–39.

5 We're covering six philosophical assumptions, the first four from the following reference and then two more the BACB has added. Whaley, D. L., & Surratt, S. L. (1968). *Attitudes of science: A program for a student-centered seminar* (pp. 7–9). Kalamazoo, MI: Behaviordelia. We've done a little bit of unmarked editing on the Whaley and Surrat sections, e.g., switching from the scientist, he, to the scientists, they. Cut 'em a little slack, they wrote this way back in the day, when few writers were tuned in to such issues.

6 Hawking, S. (2001). *The universe in a nutshell* (p. 31). New York: Bantam Spectra.

7 See Malott, R. W., & Harrison, H. (2005). *I'll stop procrastinating when I get around to it*. Kalamazoo, MI: Behaviordelia. Retrieved from DickMalott.com.

8 Fulton, B. J., & Malott, R. W. (1981–1982). The structured meeting system: A procedure for improving the completion of nonrecurring tasks. *Journal of Organizational Behavior Management*, *3*(4), 7–18.

9 For more on fear of failure, see a positive presentation in Geller, E. S. (2002). Should organizational behavior management expand its content? *Journal of Organizational Behavior Management*, *22*, 13–30; and a behavioral critique in Malott, R. W. (2002). Trait-based personality theory, ontogenic behavioral continuity, and behavior analysis. *Journal of Organizational Behavior Management*, *22*, 61–69.

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PART IV

Reinforcement

CHAPTER 6

Positive Reinforcement

Behavior Analyst Certification Board 5th Edition Task List Items		
B-2.	Define and provide examples of stimulus and stimulus class.	Pages 87–88
B-4.	Define and provide examples of positive and negative reinforcement contingencies.	Page 92 and throughout
B-7.	Define and provide examples of automatic and socially mediated contingencies.	Pages 87, 90 and throughout
F-1.	Review records and available data (e.g., educational, medical, historical) at the outset of the case.	Page 97
F-5.	Conduct preference assessments.	Pages 89–91
G-1.	Use positive and negative reinforcement procedures to strengthen behavior.	Throughout

Example Behavioral Special Education

ERIC'S TANTRUMS—PART I

Eleven-year-old Eric sat quietly in Latoya's classroom, cute enough to be on an old Norman Rockwell cover of the *Saturday Evening Post*. Middle America's stereotype of the American kid—unruly red hair, freckles, dimples, worn Converse shoes, the back of his plaid shirt pulled out of his Levis, his fly half unzipped. Then he started glancing around the room, at first on the sly, and then twisting his whole body in the process, a bit disruptive, but still cute. He wrinkled his face and began making soft noises—less cute. The soft noises quickly became sniffles, then cries, then shouts, "I hate it! I hate it! I want out! Let me out! I hate you!" The American kid's fists began pounding the desk. Eric fell out of his seat and lay on his back, now pounding the floor with his fists and kicking with his sneakers. As he had often done before, he was shouting and crying with more intensity than seemed possible from his small, trembling body, "Hate it! Hate it! Hate it!"

And, as other teachers had often done before, Latoya sprang from her desk when Eric hit the floor. Now what? She paused for an instant, unprepared. Then she ran to Eric and tried to pick him up, but his body went rigid and he started pounding on her stomach. She withdrew in pain.

"Eric, Eric, what's the matter?" she asked, with as much of a calming tone as she could achieve.

"Hate it! Hate it! Want out!"

And as other classes had often done before, Latoya's class fell apart immediately. For the other kids, this was better than reality TV. They stared at Eric and ignored their studies.

But Eric stopped more than this classroom; his shouts and pounding paralyzed the whole school, as all the teachers and staff ran into Latoya's room to give the new teacher their support. And Latoya stood there, her arms dangling at her sides, helpless, embarrassed, and ashamed. Her first day on the job and already a failure.

She felt better when Bob went over to Eric, with all the confidence his senior status and experience justified, but he, too, had to retreat from the pounding Eric gave him. If Bob couldn't handle Eric, then who could expect her to?

The staff settled for long-distance psychotherapy, being careful to stay out of Eric's reach. "It's OK, Eric." "Do you want your mommy, Eric?" "What's the matter, Eric?" And with firm finality, "All right now, Eric; enough of this nonsense. Get back in your seat and settle down." Followed quickly by a guilty, "We love you, Eric."

Also consultation: "What's the matter with this poor child?" "Just an extreme anxiety attack." "Fear of failure." "Probably dyslexic." "School phobia." "Frustrated." "He's expressing a deep-seated insecurity." "The kids tease him." "We do not," shouted a defender of juvenile morality.

Analysis

While Eric was throwing his tantrum in the school building, Dr. Mae Robinson was parking her Prius in the school's parking lot. She got out, still thinking about the meeting she had just left with the principal of West James Elementary School. She felt flattered that last week he had referred Eric to her school, the Rosa Parks Academy. The principal thought that maybe she could help Eric, after the West James school psychologist and special education teachers had given up on the boy. She smiled as she wondered if it bothered them to ask for the professional expertise of a Black woman and the youngest principal in the school district. Maybe they were just dumping Eric on her, getting rid of a problem, with no hope that she could help the poor boy. Educators sometimes grow cynical after years of disillusion. She had to force herself to stop thinking that way. She had to give them a chance, like they seemed to be giving her. But still . . .

As for Eric, well, she would just have to see. But she thought she knew what caused his problem. No internal demon expressed itself through his tantrums. No warped perception separated Eric from reality. He acquired his obnoxious, pitiful, disruptive behavior because of its consequences. And the way they described Eric's problem, it sounded like he got plenty of reinforcing consequences. He was getting more attention in 5 minutes of tantrums than most people get all day. Attention is a social reinforcer. Attention is contingent on (attention results from) Eric's tantrums. The attention probably reinforces his tantrums. He may throw a lot more tantrums than he would if no one attended to those tantrums.

This analysis seemed simple to her, though neither the principal, the school psychologist, nor the special education teacher had suggested it. She thought she knew the cause, but what about the cure? She'd have to think about that.

Mae walked across the gravel parking lot to the 80-year-old, two-story, brick school building. She had saved it from the demolition crew to house her new special school. As she approached, Eric's shouts gradually caused her to stop thinking about Eric's conference and to start thinking about Eric's reality. She quickened her pace, hurrying to the entrance of the shabby old building. Then she bounded up the inside stairs to the second floor and into Latoya's classroom.

Mae stood a minute, amazed. By this time, spectators had packed the room; not only were the teachers from the other classrooms watching and giving advice, but so were their students. This was no time to speculate further about the causes of poor Eric's problems. Mae had to act. She had to solve the problem.

What will she do? Will she succeed? Or would we be so devious as to include studies that are failures? Hold tight, dear readers; you'll find out in Chapter 10.

QUESTION

1. Give a classroom example of the way tantruming might result from social reinforcers. Notice that we say *might* because we have not experimentally shown that social reinforcement is maintaining Eric's tantruming. So far, all we have is Mae's educated guess.

THE REINFORCER (B-2)

In Chapter 2, we introduced the term **positive reinforcer**:

> **Positive Reinforcer (reinforcer)**
>
> - A stimulus
> - that increases
> - the frequency
> - of a response it follows.

A reinforcer is a ***stimulus***; and a stimulus is any physical change, like a sound or light or pressure or temperature. Stimuli might come from events, like the sights and sounds and tastes and smells of a party. Or stimuli might be the sounds and feelings coming from an activity, like the sound coming from playing the guitar or the feel of touching a sweaty opponent while playing basketball. (Stimuli is just the plural of stimulus. And you'll sound so cool and impress your friends when you use it correctly and don't say stimuluses.)

So to keep it as simple as possible, we mean *stimulus* in a very inclusive sense; by *stimulus*, we include events, activities, and conditions. So a reinforcer could be any of the following:

- Stimuli (restricted sense)—a beautiful sunset, the taste of a fruit smoothie, or a friendly smile.
- Events—a stock-car race or a Beyoncé concert, things in which our participation is more or less passive.
- Activities—playing the guitar or shooting hoops.*
- Conditions—being hot or cold, tired, or the condition (feeling) of happiness and bliss we experience when watching that beautiful sunset, while sitting on the top of a majestic mountain, with our best friend (though methodological behaviorists will squirm in their seats when we talk about feeling, happiness, and bliss in a semi-technical context; see Chapter 5).

I used to include *events, activities, and conditions* in the formal definition, but that seemed too clumsy; so I paired it down, with the hope that you'll remember that *stimulus* includes all of those.

QUESTION

1. *Positive reinforcer*—please define it, as a little refresher, and give some examples.

Examples and Non-Examples

POSITIVE REINFORCER

You're the star! You tell your friend you'll paste a gold star on her forehead as a reinforcer every time she gives you the answer to one of your homework questions. But that may not do the trick. Just because you call the gold star a *reinforcer* doesn't mean it will work as one. Another way to put it is: Will she more frequently help you with future homework? Will the gold star on her forehead help you to become a star pupil in class? If it does, then you probably have a reinforcer on your hands, or at least on her forehead.

Here's a list of questions with our answers. Now, would it be naïve of us to ask you to think through your answer to each question before you look at ours? We know thinking is harder than just reading, but give it a shot anyway.

* Technically speaking, behaviors are not stimuli. Instead, we would say the stimuli arising from these activities would be a reinforcer. But that's speaking more technically than we'd care to do.

QUESTION

What's your guess? Would a gold star on your friend's forehead normally act as a reinforcer?

OUR GUESS

Probably not, not unless your friend is about 3 years old, or into punk fashions, or both. Of course, we're just guessing, based on our experience. You'll only know for sure if you try it and see if she helps you more frequently in the future because of her star-spangled forehead. (Of course, whether something is an effective reinforcer depends on many things, such as the person whose behavior you are trying to reinforce and the specific response you're trying to reinforce.)

Question

What about other things on her face—like mascara on her eyelashes, eye shadow on her eyelids, rouge on her cheeks, and lipstick on her lips? Might they act as positive reinforcers?

Our Answer

It usually depends on what her female friends paint on their faces. But if she paints her face, then the paint on the face is probably a reinforcer for the act of putting it there. And if she pays cold cash for the stuff, then owning it must be a reinforcer for such consumerism.

Question

Mae thought that all the attention Eric got for his tantrums probably acted as a reinforcer that caused the tantrums to occur. At least that reinforcer probably kept the tantrums going once they got started. But what reinforcer maintained the giving of that attention; what was the reinforcer for everyone else, staring at poor Eric?

Our Answer

I'd guess it's the sight of the disruptive spectacle. Remember, *behavior such as looking at or attending to something occurs because that attending has been reinforced*. So if they're attending to Eric's tantruming, the spectacle is probably the crucial reinforcer. And even though the teachers in the Rosa Parks Academy were becoming expert behavior analysts, they still had a little way to go, in some cases; they still weren't sensitive enough to the possibility that their attention to

Eric's tantruming was the reinforcer for that behavior, was causing the problem behavior. It ain't easy.

Keep the following in mind: In the examples of this section, we're just guessing about what the reinforcers might be. You'd have to do an actual experiment to be sure.

QUESTION

1. Give an example of something that is probably a reinforcer for some people and not for others. Also, while you are at it, explain it.

Reinforcer Assessment

MAKE SURE YOUR ASSUMED REINFORCER REALLY REINFORCES (F-5)

Remember how we define positive reinforcer? A stimulus that increases the frequency of a response it follows. We do things that have gotten us reinforcers. And also, we stop doing things that cost us reinforcers. For example, we might get reinforcers, like smiles and approval, by being halfway decent to people. And we might lose those reinforcers by being halfway nasty to them; so we could stop losing those reinforcers by stopping our nastiness.

Still we don't know for sure if someone's smile is a reinforcer for us, at least not until we find ourselves doing things that produce that smile or no longer doing things that cause us to lose that smile.

Before	Behavior	After
You don't see her pleasant smile.	You visit her office.	You do see her pleasant smile.

For example, a crocodile smile might not be a reinforcer, unless you're another crocodile.

We all tend to use the term *reinforcer* to describe stimuli whose reinforcing value we have not shown. We tend to assume that something will reinforce a particular response of a particular person just because it has reinforced other responses of other people in the past or just because we think it would if we were that person. It's OK to start that way, though it's risky business if you don't check out your **assumed reinforcer** before going any further. Many so-called failures to modify behavior are often just failures to use a true reinforcer.

Definition: GENERAL RULE

Check the assumed reinforcer first

- Before spending much time trying to reinforce behavior.
- Make sure you have a true reinforcer.

For example, suppose you plan to use raisins to reinforce a mentally impaired girl's talking. Make sure the girl will eat the raisins first. Does the taste of the raisins reinforce her response of picking up one and putting it in her mouth?

Will this reinforce eating raisins?

Before	Behavior	After
The girl has no sweet taste of a raisin.	The girl eats a raisin.	The girl has the sweet taste of a raisin.

If it doesn't, you may be in for many long, tedious, so-called reinforcement sessions with no progress when you try to use raisins to reinforce talking. Failure to use this general rule may account for much wasted time of behavior analysts and their clients.* Once I was working with a child with serious academic problems. So I was giving him an M&M™ candy every time he read a sentence correctly. After his mouth and pockets were bulging with the candies, he said, "Look, I'll keep reading the damned sentences; but please stop giving me those M&Ms."

Remember we define reinforcers in terms of their effect on behavior, not in terms of what people say. The people may not

* Various terms have been used to designate the recipient of the services of the psychologist and, more generally, the behavior analyst. In the classroom, the term *student* has done the trick and continues to do so. But in other settings, the appropriate designation has proven more evasive: Originally, the term *patient* dominated, but that term implies a medical cause when the problem may have been the learning of dysfunctional behavior or the failure to learn functional behavior; so *client* seemed more appropriately neutral. Now, however, *consumer* is in the ascendancy, so in preparing the 4th edition of this book, I did a search-and-replace, replacing *client* with *consumer*. But it started getting too weird; so I checked with users of this book and other professionals and students, and almost everyone said to stick with *client* or some such term and to bag *consumer*. So I did a reverse search-and-replace and am pretty much hanging in with *client*, at least for a while longer.

know, or they may lie. For example, "Boys, would looking at dirty pictures be a reinforcer for you?" "Oh, no, Mother!"

In recent years, behavior analysts have become much more tuned into making sure their assumed reinforcer really reinforces. First, we'll conduct a ***preference assessment*** in order to identify items that are likely to function as reinforcers. For example, to find preferred items for nonverbal preschool children with autism, we will show the child a set of toys to play with and note the one he or she selects. And we'll repeat that procedure a few times to make sure the child has a consistent preference.

Now that we've identified some preferred items, we can be sure those items are reinforcers, right?

Not so fast. It's likely that these preferred items are reinforcers, but if we want to be sure, we have to conduct a ***reinforcer assessment*** and observe their effects on behavior. If we present these items contingent on a specific behavior and that behavior increases, only then can we be sure that we have a reinforcer. We then use those most highly preferred reinforcers when working with the child.*

QUESTIONS

1. State the "Check the reinforcer first" general rule and then give an example of where and how you should use that general rule.
2. How would you be sure that the reinforcer you're using is a true reinforcer?

Sid's Advanced Seminar in Behavior Analysis

Sid: OK, our first seminar went well, except I did all the talking. Of course, the chance to talk nonstop for 2 hours is a big reinforcer for me. But that may not be the best way for you to learn behavior analysis. I want you to learn how to think and talk like a behavior analyst. But if all you do is listen to me, then all you may learn is how to watch a behavior analyst think and how to listen to a behavior analyst talk. You learn what you do, at least if what you do gets reinforced. So I want you to start thinking and talking. Meanwhile, I'll keep thinking but do less talking. So who's first? Who wants to start thinking and talking like a behavior analyst?

Suddenly six sets of eyes looked everywhere but at Sid. Silence. Sixty seconds of aversive silence. A cough. More silence.

Sid: OK, let's put it this way: You've had a chance to read the first five chapters of *Principles of Behavior*. What do you think about the concepts of *positive reinforcer* and *positive reinforcement?* Do you have any questions? Any comments?

Silence for another awkward 60 seconds.

Sid: OK, let's put it this way: We just did a 2-minute baseline. Now we'll intervene. You earn a point every time you respond, at least if you say something relevant. The points will all count toward your final grade. They add in with your weekly quizzes, term paper, and midterm and final exams. Now, any questions or comments?

Ten more seconds of silence. Max raised his hand.

Sid: Yes, Max?

Max: Is this behavioral intervention a positive reinforcement procedure?

Sid: Why don't you tell me?

Max: I think it is.

Sid: What's the behavior?

Max: Saying something relevant?

Sid: Right. And what's the reinforcer?

Max: The points.

Sid: You get 1 point! Next?

Joe: I don't think you should be so sure you have a reinforcer.

Max: Why not?

Joe: You don't know for sure that your points are a reinforcer. To know if they're reinforcers, you'd have to show that our talking increases because of their contingent use.

Sid: Excellent point. I'm only assuming I have a reinforcer. And you've just earned one assumed reinforcer.

Max: And to find out why these points might be reinforcers, we'll have to wait until Chapter 12.

* Warning: The child's preference may shift considerably from day to day, or even hour to hour, or even within a single teaching session; and even the most preferred reinforcer will lose its reinforcing value. It's probably not hard to imagine that conducting preference assessments is much easier and less time consuming than reinforcer assessments. Therefore, it might be most reasonable to skip the reinforcer assessment and use the items identified in the preference assessment, but then keep a close eye on how the child responds during your session. If he or she keeps hanging in, keeps responding, keeps accepting the items that you deliver, it's likely that you have a reinforcer. However, if the child stop responding, or starts pushing the items away when you give them, you might want to look for a new reinforcer.

QUESTION

1. How can you tell if the points for answering questions are reinforcers?

Example Behavioral Special Education

JIMMY, THE CHILD WITH AUTISM—PART I

Jimmy Lewis had been given the diagnosis of autism at the age of 2; he was now 3. At the moment, he was sitting in the middle of the living room floor. As his mother and the new occupational therapist watched, Jimmy engaged in a mix of arm flapping, head rolling, eye squinting, and full-body rocking.

"This is how Jimmy spends most of his day. It's so depressing . . ."

"I'm so sorry, Mrs. Lewis. I know it can be difficult."

Jimmy's seemingly pointless **behavior** was quite painful for his parents to watch day after day. Like many children with autism, Jimmy's **repertoire** included a variety of self-stimulation behaviors—behaviors that are automatically reinforced by the sensory stimuli from that behavior, like singing or twirling. Also, skills children normally have by the age of 3 were conspicuously absent from his repertoire. Jimmy didn't make eye contact, talk, or play with toys the way most kids do. Instead of rolling cars down the ramp, he would hold them in front of his face and simply stare and stare at the spinning wheels.

"The occupational therapist we had worked with told us that he has a sensory processing disorder," Amy Lewis said, "and that's why he has to do this type of behavior."

"Did your former therapist say what a sensory processing disorder was, Mrs. Lewis?" asked Kate, the newly referred occupational therapist (OT) who had just gotten her MA from Big State University last year and was the newest BCBA in town.

"Well, kind of, but I was a little confused. I'm no neurologist after all."

"I might have a simpler explanation for why your son does his self-stimulation behaviors so often," Kate said. "And you might be surprised at how useful this explanation will be."

Having studied **behavior analysis** as well as occupational therapy, Kate was a master of the basic principles of behavior. So, rather than relying on the hypothetical concept of sensory processing disorder (an explanatory fiction) to explain Jimmy's behavior, she told Amy about the concept of **reinforcers**. Many **stimuli** arose when Jimmy flapped his hands and engaged in all his other stereotypic behaviors. He could see his hands moving quickly in front of his face. He could feel the air on his face. Rolling his head repeatedly led to some interesting sensations of dizziness. These stimuli arose every time Jimmy engaged in his repetitive behaviors. And Jimmy kept stimming* and stimming. Kate suspected that because these stimuli had greatly increased the stereotypic behaviors they followed, they were probably functioning as reinforcers for those stereotypic behaviors.

"So you're saying there's nothing wrong with my son's sensory processing?" Amy asked.

"I'm saying there's a much simpler way to explain his behavior," Kate replied, "and I've seen this and the other principles of behavior at work with all my clients. Actually, not just my clients, but myself and all living things."

"But if these reinforcers affect everyone, then why aren't we all stimming like Jimmy?" Amy challenged.

"Oh we are!" Kate answered. "I've been tapping my foot nonstop since we sat down. And you've been twirling your hair off and on as well."

"That's just because I'm nervous, and those innocent behaviors are nowhere near as bad as my son's."

"That's true, but they probably would be, except you and I are very aware of how other people regard us. For our whole lives, we've gotten social disapproval from those around us for stimming in an obvious way. But our subtle behaviors have kept up just as much as Jimmy's more obvious ones. That's the power of reinforcers."

Another term for this type of reinforcement is **automatic reinforcement**. This means the behavior itself automatically produces the reinforcer—the cool sensation. No one else needs to be around to reinforce Jimmy's self-stimulation behavior because the behavior itself produces all of the reinforcers needed to increase and maintain the frequency of

* Stimming is the behavior-analysist's cute way of saying "engaging in self-stimulation behavior."

his stimming. Same goes for Kate's foot tapping and Amy's hair twirling.

The other type of reinforcement is **socially mediated reinforcement**. This means that the reinforcers are delivered by another person.* Like when Eric received all that attention whenever he threw a tantrum, you could say that was socially mediated reinforcement because the reinforcer (attention) was not automatically produced by the behavior itself; it was delivered by someone else (the audience).

Definition: CONCEPT

Automatic reinforcement

- The response itself automatically produces the reinforcer.

Definition: CONCEPT

Socially mediated reinforcement

- Another person (or organism) provides the reinforcer.

QUESTION

1. Please define and give an example of:
   a. *automatic reinforcement*
   b. *socially mediated reinforcement*

Concept

POSITIVE REINFORCEMENT CONTINGENCY (B-4)

We've been talking about the concept of reinforcer, a fundamental concept in the analysis of behavior. Now we need a principle for tying the reinforcer to the behavior. ***Positive reinforcement principle***: *A response will occur more frequently if a reinforcer or an increase in a reinforcer has followed it in the past, in similar settings*. One thing to note about this definition is the phrase *in similar settings*. Reinforcing your obscene joke telling when you're with your buddies may not increase its frequency when you're with your parents; and we'll deal with this more when we get to Chapter 14.

But rather than concentrating on the positive reinforcement principle, we'll concentrate on the definition of the positive reinforcement contingency, because that's the definition you'll use most. A little reminder from Chapter 2:

> A **positive reinforcement contingency** is the response-contingent **presentation** of a reinforcer, resulting in an **increased** frequency of that response.

And another reminder, 'cause it ain't easy: ***Response contingent*** means *caused by the response* or *produced by the response*. For example, in Chapter 2, each time Juke's grandfather said something sensible, his grandmother said a few kind words and caressed him—reinforcement by the presentation of reinforcers—positive reinforcement. And each time his grandmother properly reinforced his grandfather's sensible talking, Juke immediately praised her efforts—more reinforcement by the presentation of a reinforcer—positive reinforcement.

Also, in Chapter 2, Rod cried and Dawn ran into his bedroom—unplanned positive reinforcement by presenting reinforcers. Dawn unintentionally reinforced the crying, and that reinforcement increased the frequency of Rod's crying on future nights.

And we hope the concepts you learn as you read this book reinforce your reading so that you'll become a behavior analysis junkie—or at least finish the book.

More examples: We take a bite of a delicious apple—positive reinforcement, the taste. We kiss our significant other—positive reinforcement. We watch a TV show—reinforcement. True, the reinforcers from watching the tube often hold little value—you don't get much out of it, but then you don't put much into it either, as you sit there like a spaced-out zombie, staring at something really lame like *The Walking Dead* or *The Bachelor*. Hang your head in shame! Why aren't you reading *Principles of Behavior* instead? Positive reinforcement of learning fascinating new concepts. (Of course, we're just interpreting everyday life. To be sure we're interpreting correctly, we'd have to show that our assumed reinforcers really are reinforcers. And assuming they're reinforcers without checking them out can lead to failure when trying to modify behavior.)

* Of course the other "person" could be an animal, especially when one animal reinforces the behavior of another animal or when Donald Dog reinforces your asking it to shake hands. But we usually just use the concept with people.

Here's a hypothetical example: Your professor's calling on you reinforces raising your hand in class. Laughing at your professor's jokes reinforces your professor's telling jokes. Your professor's jokes reinforce your efforts to stay awake. But eventually sleep wins. Then your startle response reinforces your professor's telling a boisterous joke about the student sleeping in the back row.

You can strengthen concrete by sticking steel rods in it. Then you have reinforced concrete. You can strengthen behavior by sticking a reinforcer after it. Then you have reinforced behavior. Of course, reinforcement for the civil engineer differs from reinforcement for the behavioral engineer. But they're similar, too.

Again, how quickly should we give the positive reinforcer for the reinforcement to occur, for the contingency to be a positive reinforcement contingency? Certainly less than 60 seconds; ideally, only a fraction of a second. But it's not all or nothing; as the delay between the response and the reinforcer increases, there's a sharp decrease in the effectiveness of the reinforcement contingency. This is described in the following principle:

Delay gradient

- *The effects of reinforcement and punishment contingencies*
- *decrease*
- *as the delay between the response and the outcome increases.*

And, as we keep emphasizing, positive reinforcers delayed more than 60 seconds have little or no reinforcing effect. This is also true of negative reinforcers.

QUESTIONS

1. *Positive reinforcement contingency*—define it, use it correctly in a sentence, and diagram three examples. Warning: Each line of a definition is a separate, crucial component of the definition. Any line missing means you ain't got it. Remember, precision is next to godliness.
2. What is the principle of the delay gradient?

Concept

BEHAVIORAL CONTINGENCY

Now let's look a little deeper into the more general concept of **contingency**. There is a contingency between Eric's tantrums and the spectators' attention. Put another way, his tantruming causes, produces, results in everyone's attending. His tantruming causes the attention: no tantruming, no attention or, at least, less attention. So a contingency is a *causal relationship*. And **to be contingent** means *to be caused by*.

We'd say: Getting good grades is *contingent* on studying. Sid's happiness is *contingent* on Dawn's saying she loves him. Your car's starting is *contingent* on your turning the key in the ignition.

Thus, the spectators' attention is often *contingent* on (dependent on or caused by) Eric's tantruming. Of course, Eric sometimes gets attention when he's not tantruming, so on those occasions the attention is not contingent on his tantruming.

Definition: CONCEPT

Behavioral contingency

- The occasion for a response,
- the response, and
- the outcome of the response.

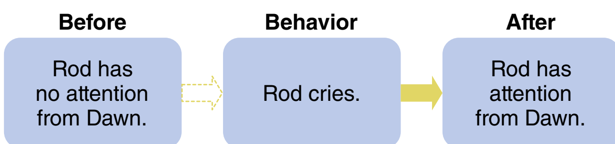
Here are some other behavioral contingencies relevant to the concept of ***occasion***:

Your boyfriend's being with you is the *occasion* in the presence of which crying and smiling will produce their outcome—a kiss. Your teacher's looking at you is the *occasion* in the presence of which raising your hand will produce the outcome of being called on. *The **occasion** is a stimulus in the presence of which a particular response (behavior) will produce a particular outcome*.

In Chapter 14, we introduce **discriminative stimulus**, the technical term for *occasion*, as behavior analysts use the word. So we will make no further use of this concept until that chapter; but note that the *occasion* and the *before condition* are *not* the same thing.*

* Though these diagrams include three boxes, don't confuse them with the traditional "three-term contingency." The traditional contingency includes a discriminative stimulus (a.k.a. "cue"), a behavior, and an outcome. But we've found it's asking for trouble to prematurely introduce discriminative stimuli (a formal term for occasions or cues), so our first box is simply the "before condition," not the discriminative stimulus. However, we will be able to deal gracefully with nondiscriminated contingencies and tiptoe around the discriminative stimulus in discriminated

We usually leave the before condition in the contingency diagram, even though it's not an official part of the definition of a behavioral contingency. We stress the before condition because it will help you distinguish between the various types of contingencies we'll be looking at in the remaining chapters.



So you can see the contingency between the behavior and the reinforcer is the big deal. The reinforcer is *contingent* on the behavior; in other words, the reinforcer is *caused by* the behavior. And that behavior-reinforcer contingency results in the reinforcement of the behavior; put another way, the reinforcement makes future occurrence of the behavior more frequent.

Now, to really understand a concept, you need to be familiar with non-examples of the concept as well as examples. So let's look at a few noncontingent events, events that are *not contingent*. *A* ***noncontingent event*** *is an event that is not dependent on anything*.* It is *not contingent* on the behavior we're interested in. The kinds of contingencies in which we are most interested are response contingencies, contingencies where the event is contingent on the response (caused by the response). So when we speak of noncontingent events, we mean events that aren't caused by the response of interest.

In theory, at least, a parent's love should be noncontingent (unconditional love); that is, the parent should not make their love contingent on the child's behavior. On the other hand, the wise parent will provide approval only when the child is behaving well. So approval would be contingent.**

You might think rain is contingent on your going on picnics. But it probably is noncontingent. However, your going on picnics is contingent on its not raining (though that's not what we'd call a **behavioral contingency**). Or what about the child who sneezed right before the electricity failed and the lights went out all over New York City? The power failure was not contingent (dependent) on the sneeze. The lights would have gone out even if the child had held back the sneeze.

QUESTIONS

1. *Behavioral contingency*—define it and give an example.
2. Use some version of the verbal expression *to be contingent* in a way that shows you understand how to use the term correctly. For example, *Attention is contingent on Rod's crying*.
3. And also use some version of the verbal expression *noncontingent* (or *not contingent*). For example, the rain is *not contingent* on you going for a picnic, even though it may seem like the rain gods are just messing with you.

Example Behavioral Special Education

THE "NONCONTINGENT" DELIVERY OF REINFORCERS

Skip Larson was the principal of Street School, an alternative high school for street kids, dropouts who spent most of their time hanging out. He and Mae were chatting.

Mae asked, "So how are things going at Street School these days?"

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contingencies until we get to Chapter 14, where we will give the concept of discriminative stimulus the rigorous treatment it needs. And, by nondiscriminated contingencies, we mean those contingencies for which the response will produce the reinforcer on almost any occasion. For example, almost always when you breathe, you will get air. Furthermore, many contingencies in everyday life are nondiscriminated, and a premature introduction of the concept of discriminative stimulus causes students to try to force a discriminative stimulus on every contingency, even when it doesn't fit.

And finally, for those familiar with the concept of motivating operation, the before condition is also not necessarily the same as the motivating operation, except in the case of reflexive motivating operations, as you will see in Chapter 13. Even though at first glance it doesn't look like we need the before condition, both our undergrad and grad students appreciate our including it.

* Or, at least not dependent on the behavior of interest.

** Incidentally, students sometimes raise the point that the teacher's approval isn't always a reinforcer, especially for older children when they're sitting in front of their buddies. In that case, we would call the approval a ***conditional reinforcer***—approval is a reinforcer *conditional upon* (depending on) the absence of the buddies. In other words, the conditional reinforcer is the compound stimulus consisting of approval *and* all buddies absent.

Skip answered, “Not bad, except we have a hell of an attendance problem. Trying to keep those kids in school’s like trying to keep water in a sieve.”

“You mean they walk out in the middle of school?”

“Yeah—if they show in the first place. We have about 30% attendance. The lowest in the district.”

“What do their parents say?”

“Darn little, if they say anything at all. They’re as hard to get ahold of as the kids. Some kids don’t seem to have parents. Any ideas?”

“I’m not sure. You’ve got a tough one, all right.” Mae paused a moment, to give the impression that she was thinking, before she started giving the advice she had given so often before to other principals and teachers. “I’m not sure, but I think you have to make Street School the best game in town, the most reinforcing place these kids can find. It’s got to beat the street.”

“Yes, but they’ve got to work in school. It can’t be all fun.”

Mae thought, another *yes-but* guy; however, she said, “You’ve got a good point there. Still, you might need to flood your school with reinforcers.”

“Yes, but I’ve heard you say noncontingent reinforcers don’t work.”

“True,” Mae said, “if the reinforcers are not contingent on specific study behaviors at school you won’t get much learning. But if you simply fill your school with free reinforcers, reinforcers that are not contingent on studying, they still will be contingent on one crucial behavior.” Mae paused, to give Skip a chance to ask, “What’s that?”

“Going to school,” Mae replied. “Creating a generally reinforcing environment should reinforce entering that environment. And being a generally reinforcing person should reinforce interacting with that person.” Mae smiled, an act that reinforced Skip’s interacting with her, though both were unaware of the reinforcement taking place before their eyes.

“So, we should make sure that even a poor student contacts plenty of reinforcers in school. That way, the kid will need less coercion to get him or her to come to school.”

“I think you’re right, Skip.”

Now Skip smiled, possibly indicating that he’d just received a reinforcer.

Mae went on, “But, of course, the more we also manage to make those reinforcers contingent on studying, the more frequently we will reinforce studying and the more the poor student will learn.”

This is an example of the ***environmental enrichment general rule***—

- *you can increase the frequency of entering a setting*
- *by putting more reinforcers in that setting,*
- *but you will have to make some reinforcers contingent on productive behavior*
- *if you want to increase productivity in that setting*.

We make a big deal of the fallacy of environmental enrichment, because we think it’s a loser, not because it’s a winner. Most people change the environmental quality with the false notion that it will increase productivity, not with the correct notion that all it will do is increase the frequency of entering a setting. The problem is that such people don’t understand the principle of reinforcement—the need for making reinforcers **contingent** on the behavior they want to increase. This general rule is not a basic one in behavior analysis; it’s mainly something you should know about so you can avoid being confused by it. On the other hand, Mae was on top of it, as usual: She’s recommending environmental enrichment to reinforce the kids coming to school, but she’s also recommending making some reinforcers contingent on studying.

(By the way, when we critique the notion of *environmental enrichment*, we’re using the phrase in a different way than those concerned with the protection of our environment. We, too, think a clean, healthy, well-preserved environment is crucial to the salvation of humanity.)

Example Organizational Behavior Management

THE “NONCONTINGENT” DELIVERY OF REINFORCERS

Dora Dollar (President of Monster Machines, Inc.): Productivity is down 25% in the last quarter. How can we expect good Americans to buy our cars if we don’t manufacture them? Before long, we’ll all be driving foreign cars if we keep going at this rate. Now's the time for you high-priced consultants to earn your keep. Give me a hand with this one.

Freddie Feelgood (Representative from Sensitive Souls, Inc.): Well, frankly, Ms. Dollar, who could work in this icky factory? It's so gray and cold. You need to add many rich warm colors. And add music. Yes, some peppy music to make the workers want to work. And company picnics where they can get to know you better.

Dora Dollar: Sounds good to me. Now let's hear from the new kid. What do you call yourself? A behavior analyst? Well, what do you think of Freddie's proposal?

You: (Representative from Behavior Analysts, Unincorporated—your first day on the job since graduating from the university last week): ______________________________ (Please fill in the blank with your response to Dora's question. Indicate what's wrong with Freddie Feelgood's suggestion; show how his proposal is a case of misunderstanding the environmental enrichment general rule, and show how your use of contingent reinforcers would increase productivity.)

Dora Dollar: The most brilliant, yet tactful, critique I've ever heard. Would you consider heading our Department of Human Resources? Of course, we'll double your current salary.

Freddie Feelgood: I have to hand it to you kid, you sure know your stuff.

You: Gee, thanks. I owe it all to my diligent study of *Principles of Behavior*.

Freddie Feelgood: Where can I get a copy of that book?

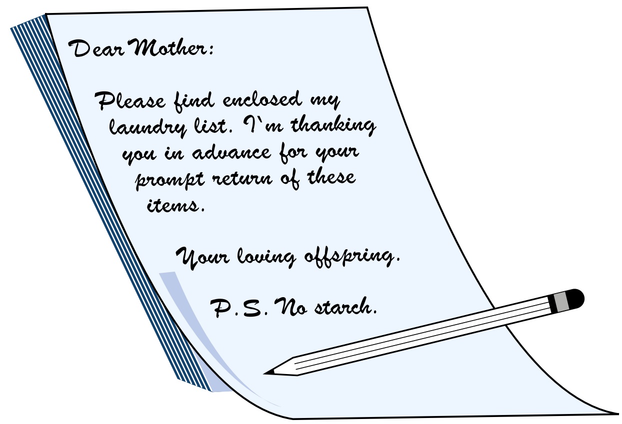
QUESTION

1. The general rule of environmental enrichment—give a couple of examples.
   a. One that illustrates the fallacy of its use.
   b. One that illustrates its proper use.

THE DELIVERY OF REINFORCERS BEFORE THE BEHAVIOR

Remember the reinforcement principle? *A response will occur more frequently if a reinforcer or an increase in a reinforcer has followed it in the past*. Check out that word *followed*. Remember it, and it'll save you grief. And for reinforcement to occur, the reinforcer must *follow* the response within a few seconds (less than 60).

Is "thanks" a reinforcer? Might be. Does thanking in advance reinforce the behavior thanked? No way. The reinforcer must follow the behavior, not precede it.



The Bribe

The sleazy, middle-aged man pulled an envelope out of his pocket and slipped it into the hand of the tall, lean, young woman. Then he spoke without looking her in the eye and without removing the cigarette from the corner of his mouth. His left eyebrow twitched as he said, "The odds are 5 to 1 in favor of your team's winning the NCAA volleyball championship. Mr. Big has bet a lot of money on your team's losing. So here's $10,000 for you to throw the game."

Reinforcement? No. Because the $10,000 comes before the despicable act, not right after it.

Bribery? Yes. Bribery is the use of a reinforcer, often (but not always) given in advance, for the performance of an illegal or immoral act.

But advanced payment for a good deed isn't bribery. For example, paying someone $20 before she mows your lawn isn't reinforcement, because it occurs before the act. But it isn't bribery either, because lawn mowing is neither illegal nor immoral.

And payment after an evil deed is bribery. For example, Lazy Larry could pay Studious Steve after Steve helped him cheat on the final.

I'm making a big deal of bribery because critics often accuse behavior analysts of using bribery. But such critics aren't thinking too clearly. True, bribery often involves reinforcers. True, the behavior analysts' reinforcement uses reinforcers. But that doesn't make reinforcement the same as bribery.

Here's the crucial moral distinction: On the one hand, bribery involves reinforcers for immoral or *illegal* deeds; on the other hand, the behavior analysts' use of reinforcement and most pay-for-work involves reinforcers for *good* deeds.

Note that we usually assume money is a reinforcer even when it's not being used in a reinforcement procedure. For example, giving money in advance of the behavior isn't reinforcement for that behavior, but probably the money is a reinforcer. That means we could use the money to reinforce behavior if we made that money contingent on behavior.

You Really Oughta Wanna

Now here's what may cause part of this confusion: Because of a simple-minded, false morality, many people don't want to give people reinforcers for doing things they think should be done without added reinforcers.

Parents don't want to give their kids special treats for being good because kids ought to want to be good without the treats. Teachers don't want to give their students special privileges for doing well on quizzes because students ought to want to do well on quizzes without the special-privilege contingency. And employers don't want to give their workers time off from work for meeting production goals because the workers really oughta wanna meet the goals without the time-off contingency.

This is a false morality because using reinforcers in these sorts of contingent ways can only make life better for everyone. No one gets hurt. Refusing to do it is cutting off your nose to spite your face. Nonetheless, many people object. And when they do so, they often say, *I don't want to bribe my kids, my students, my workers*. But we think they're just confusing their own cultural prejudices with bribery. And, of course, they don't think the pay they get for their work is bribery. (By the way, we borrowed the phrase really oughta wanna and the critique from Robert Mager and Peter Pipe.[1])

QUESTION

1. Give two examples that at first glance might appear to be reinforcement but are not, because the apparent reinforcer comes before the response.

Example Behavioral Child and Family Counseling

BUBBLEGUM AND BOWEL MOVEMENTS—PART I

Soon after Dawn arrived at her office in the psychology clinic, she got a phone call.

"This is Dr. Baker. Can I help you?" she said.

"Yes, Dr. Baker, this is Dr. Mario Acosta from the children's wing of University Hospital. I've got a problem—a 3-year-old boy, Todd. For the last year he's been averaging only one bowel movement per week; sometimes he goes for 10 days without a bowel movement; he claims it hurts."

I'd think it would after a week, Dawn thought.

"We've done all the exams in the book, including a barium enema x-ray."

Dawn flinched; she had gone through that procedure herself—not something she wanted to try again.

"The exams found nothing. We've changed his diet several times; only helps for a week or so. The poor kid is hurting, and we've done all we can. Would you look at him?"

The next day Dawn talked to Todd and his mother. She thought about her little boy as the mother described the discomfort Todd suffered. Then she thought of Sid and how he would laugh at the simple-minded solution she was mulling over. If a behavior isn't occurring often enough, what can you do? Well, you can try to reinforce that behavior when it does occur. Reinforce bowel movements? Sounds crazy. Let's hope it doesn't sound crazy to Todd's mother.

After talking more, Dawn said, "Here's what I'd like you to do. I'd like you to give Todd a treat each time he has a bowel movement. I think that will help him. Within a few weeks, he should be having a bowel movement almost every day." She tried to sound more confident than she was.

"Are you serious, Dr. Baker? I don't see how a reward can help Toddie with his natural biological processes."

"No guarantees, but it's our best first bet. Besides, Dr. Acosta said he'd prescribe a mild laxative to reduce the pain. Also, the laxative will help Todd have some bowel movements so you will be able to use the treats."

"What should I use, Doctor?" While the mother asked her question, Todd pulled on her sleeve and mumbled something Dawn couldn't hear. The mother reached in her purse, pulled out a piece of bubblegum, unwrapped it, and gave it to her son—a well-practiced ritual.

Dawn said, "Bubblegum."

"Oh, I'm sorry," the mother said. "How rude I am. Would you like a piece of bubblegum, Doctor?"

"No, thank you. I meant use bubblegum as the treat."

Todd's mother did use Dawn's procedure and the bubblegum reinforcer. She gave Todd a piece of gum immediately after each bowel movement, but not before.

Dawn's simple intervention worked! If you want a behavior to occur more frequently, reinforce it. During the second week, Todd had six bowel movements. He was a proud young man—a young man in control. From the fourth week on, he had six or seven bowel movements each week (Figure 6.1).

This happened each week, except one. Todd spent the 14th week with his grandmother, but his parents had forgotten to tell her about the bubblegum intervention. So Todd fell to a humiliating and painful two bowel movements that week. Then he returned home to his bubblegum contingency, and he became his old six- or seven-per-week self again.

Todd's mother confessed a side benefit of the bubblegum contingency: "Dr. Baker, I didn't tell you, but Todd and I hadn't been getting along too well. I used to nag at him about his bowel movements and force him to sit on the stool for long periods, with no success. And my temper got short. But now we're getting along really well. It's fun to be a mother again. I like giving him his, what did you call them . . . reinforcers."

Todd was happy, his mother and father were happy, his grandmother was happy, Dawn was happy. Everyone was happy, except Sid. "Fine, now you've got a 3-year-old kid addicted to bubblegum? A bubblegum monkey on his back. Will his mother have to go to college with him to deliver the bubblegum after each little success?"

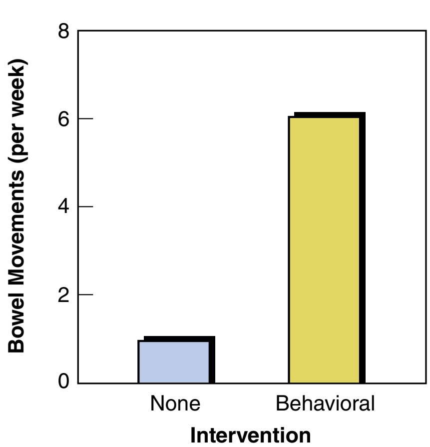


Figure 6.1 Bubblegum Reinforcement of Bowel Movements

Sometimes Dawn wished Sid were less of a wet blanket, but, as usual, he had a good point mixed in with his sarcasm. Now what should she do? Future chapters, dear reader, will tell.

QUESTION

1. Suppose you had a child with severe problems of bowel retention. How could you use the principle of positive reinforcement to help the child? Describe:
   a. the behavior
   b. the contingency
   c. the reinforcer
   d. the expected results

Example Behavioral School Psychology

POVERTY'S CHILDREN—PART I

Mae's father, the Reverend C. L. Robinson, had programmed a set of values deep into Mae's soul. She should always give 10%, a tithe, to the church and even more to the Black community. Nothing is lower than Black folks who forget where they came from. You have the blessing of a fine education that gave you what it took to earn your PhD. You have the blessing of a fine job where you can do worthwhile things. Now you have to give some of that back to where you came from, and Mae knew he did not mean back to her parents.

Reverend Robinson had retired from the pulpit, but he hadn't stopped preaching. Every Sunday night, when Mae called home, she got a sermon. He didn't exactly ask her what she had done for the Black community that week, but he might as well have.

So Mae couldn't refuse when some friends from her sorority asked her if they could use one of her classrooms as a preschool for 15 children from low-income families, especially when she found out they were Black children. Not only did she find the space, but she also found some money to run the program. And she, herself, helped supervise.

Her friends enrolled fifteen 4- and 5-year-old children in the preschool. Then Mae's staff went through the ritual of giving the children the Peabody Picture Vocabulary Test. And they got the results Mae knew they would. The children scored an average of 79, that's 21 points below the national average.

This meant terrible language skills, of course. Poverty almost forces you to have weak formal language skills. If you're poor and you're 4 or 5 years old, you hardly have a chance, at least not in school.

Even though Mae knew how the tests would turn out, hearing the results depressed her. She hated psychological tests. They didn't help people. They just pigeonholed victims. Then the authorities would have an excuse when the teachers failed to teach the children.

When Mae talked to Juke, her boyfriend, about the results, he reminded her that the tests were culturally biased. For example, these White-oriented tests didn't measure the rich, expressive language her Black children had.

True, but the tests did predict how the children would do in school. With a score of 79, they had terrible formal language skills and would most likely fail in school.

Juke also reminded her that IQ tests measure learned behavior, not innate intelligence. He even suggested there was no such thing as innate intelligence.

True.

Then all Mae had to do was to teach her 15 children what they would need, so they could succeed in school. Wasn't she the best behavior analyst in the school system? So what if everyone else had failed in trying to help kids like these. Not many people who really cared about Black children knew as much about behavior analysis as she did. She could do it.

Thank God for Juke. She would do it.

But that night, Mae couldn't sleep. From her own experience, as well as that of others, she knew that racism made life hard for all Black Americans. And she knew that poverty made life hard for everyone. But when you combine the two, life's really hard. And if these children don't have the language skills they need to do well in school, that will all combine to make life harder than hard. They're likely not to find a good job, or any job. (The unemployment rate is nearly twice as high for Black Americans as for White Americans.[2])

Young Black American men are 13 times more likely to die of homicide than are White American men.[3] You're more likely to do time in prison. ("Black males ages 18 to 19 were 11.8 times more likely to be imprisoned than white males of the same age."[4]) You're more likely to try heroin. Your children are more likely to die before they're old enough to enter preschool. (Twelve out of 1,000 Black American infants died before preschool, in comparison with five out of 1,000 White infants.[5]) And the infants who do survive? They're likely to become victims in the statistics of Black poverty. Also their grandchildren after them. And their great-grandchildren, too.

Mae knew these horrible stats by heart. And she knew they didn't apply to middle-class Black people like herself. They applied to the children of Black American women living in poverty, as 34% do, and also to the children of White women living in poverty, as 12% do.[6] They applied to her 15 students (all victims of poverty). She also knew this sounded melodramatic, like something out of a soap opera, but it was true. All the statistics on poverty and race said so, and she'd seen too much of real life to deny the statistics. She knew that poverty wasn't a direct cause of these problems, but the conditions often associated with poverty were. She had to change some of those conditions.

Only Mae could save those 15 children and the generations who would follow them. Mae tried to tell herself that she exaggerated, but she knew these particular statistics didn't lie. Only she could help these children get the skills they needed to help them climb out of poverty and poverty's fate. These thoughts frightened her, but they also made her high. She was living a life with a purpose!

So Mae knew what her goal was; it was to help these 15 children learn the formal language skills that would make it more likely they would do well in school, which would give them a fighting chance of escaping many of the hardships of poverty. It wouldn't end racism, but it could help these 15 children have a chance at living a less stressful life.

The next day Mae and the preschool teachers started a program to help the children. What were their language-skill deficits? For starters, after a few observations, the teachers concluded that the children rarely used adjectives. They might say *car*, but not *red car*; they might say *ball*, but not *big ball*. They didn't use color names, size, shape, or numbers.

So what should the teachers do? Try positive reinforcement—what else! Using adjectives is behavior. If behavior doesn't occur often enough, reinforce it. Each time a teacher heard a child correctly using an adjective with a noun (*red car*), the teacher would smile at the child and offer an approving comment. The teachers used this reinforcement procedure throughout the 3-hour session every morning, during breakfast, structured time, and free play—wall-to-wall reinforcement of adjectives.

And what happened? Nothing! Twenty-eight class sessions. Nothing. A dismal three or four adjectives per hour. Nothing.

Should we conclude that the children were genetically inferior, as some racists argue? That they were too dumb to learn? Mae knew that wasn't true. Should we conclude that positive reinforcement didn't work with these children? Mae also knew that wasn't true; reinforcement works with all God's creatures. Should we conclude that the teachers' approval wasn't a reinforcer? Perhaps, but Mae didn't think so; she'd never known anyone for whom approval wasn't a big reinforcer. Then what should we conclude? Mae wasn't sure.

She and the teachers talked it over. Maybe the children didn't have the words in their vocabulary, in their repertoire. And even if they could say the words, maybe they couldn't use them correctly. Even if they could say *car*, maybe they couldn't say *two cars*, *red car*, *small car*, *long car*, at least not at the right time. Hard to believe, but maybe.

For the time being, they would conclude that the children's baseline rate (pre-intervention rate) of using adjectives correctly was too low for reinforcement to have much effect. Maybe the frequency of using adjectives was too low to provide enough occasions for reinforcement. The children had to respond correctly at least sometimes so the teachers could reinforce those responses frequently enough to produce an effect. So maybe they hadn't had wall-to-wall reinforcement.

Poverty had won this round, but Mae, the teachers, and her 15 children hadn't quit fighting. You'll read more about their noble battle with poverty in Chapter 14.

QUESTIONS

1. How does poverty relate to language skills and IQ scores? Language skills and success in school? Success in school and employment? Employment and a halfway decent life for yourself? Employment and a halfway decent life for your children, for your grandchildren, and for your great-grandchildren?
2. After an initial failure to improve behavior with a reinforcement procedure, what should we not conclude about the person's genetic quality, intelligence, ability to learn, and ability to have behavior reinforced?

HOW TO TALK ABOUT BEHAVIOR

Often people really screw things up when they use everyday language and everyday approaches in a scientific context.

Here's an example of what not to say: *Rudolph the Rat pressed the lever because he* ***expected*** *to get a drink of water*. What's wrong with that? *Expected* is what's wrong, for two reasons: First, you don't know what the rat expects, or if it expects anything, or if it even can expect; you're making an unjustified inference (an unjustified guess). Furthermore, your guess is just another example of the error of circular reasoning: *Rudolph pressed the lever because he expected water*, and you know that he expected water because he pressed the lever, and so on—around and around.

Second, the verb *to expect* describes a very complex activity, when you stop to think about it. Probably expecting something involves language skills (verbal behavior). And we have no reason to think rats can talk or even think (as most thinking is probably based on language).

So what should you do? Keep it simple; talk about only what you know. *Rudolph pressed the lever because that response has produced a drop of water in the past*. Keep it simple.

The same with ***knows***. Don't say *the rat knows it will get a drop of water*. More circular reasoning.

And the same with ***thinks***. An unjustified circular inference of activity that's probably a little too much for Rudolph, because he doesn't have language skills.

For example, why does Sid scratch himself? Because he thinks scratching will stop his itch? Really? *Hey, Sid, did you know you were scratching yourself in a private part of your body, when you were standing in front of your class lecturing? Oh, my gosh, no! Was I really? How embarrassing*. In this example, not only did Sid not think his scratching would relieve his itch, he didn't even think he was scratching. Of course, the relief from the itch probably reinforced Sid's scratching in the past, and that's why he's doing it now but that happens automatically, even though Sid isn't even thinking about it and even though Sid has pretty good language skills. So we can't even assume Sid, let alone Rudolph the Rat, knows, expects, or thinks reinforcement will follow his response. And that's true, even though the occurrence of past reinforcers has reinforced that response and that's why Sid and the rat are currently responding.

Along the same line, don't say, *Rudolph the Rat* ***figured out*** *that he'd get a drink of water if he pressed the lever*. Again, this implies that Rudolph has language and has thought through the problem, solved it, and now can state to himself the rule describing the contingency. No way. And the same goes for the nonverbal children who have not yet learned to talk, both typical and autistic children. And that's one of the reasons we behavior analysts are spending so much time helping children with autism learn verbal skills that they probably would not learn without our help.

Also stay away from ***learned that***, as in *Mr. R. learned that his lever press would produce a drop of water. Learn*, by itself, usually isn't too bad. *Rudolph learns lever pressing. You've learned to say thank you when someone holds the door open for you*. But *learns that* usually implies that now Rudolph has *figured out* that or *knows that* or *thinks that* his lever press will get him that drop of water.

Also, don't say, *Rudolph pressed the lever **in order to get** the drop of water*. Don't even say, *Rudolph pressed the lever **to get** the water*. Why not? Because that implies a certain intentionality, as though Rudolph has figured out what to do and is doing it because he knows what he'll get for doing it. The same goes for nonverbal human beings. Don't say, *Rod cries **to get** attention*. Rod just cries because that behavior has been reinforced. Along the same lines, don't say, *Rod's **trying** to get attention by crying*.

And don't say, *Rudolph **makes the connection** between his lever press and the reinforcer*. Don't even say, *It's important to deliver the reinforcer immediately because then it's easier for Rudolph **to make the connection** between his lever press and the reinforcer*. Why not? Well, pretty much the same as the others. It sort of implies Rudolph is a thinking, verbal organism. And, if you're serious about it, it's circular. At the very least, it adds nothing. And, as always, the same goes for nonverbal human beings.

Same goes with *associates*, as in *Rudolph **associates** the lever press with the water*. As we suggested before, you can say, *Rudolph presses the lever now, because that response has been reinforced in the past*. Simple, clean, elegant, no nonsense, no unjustified inferences.

Same with ***wants***. Don't say *the rat **wants** a drop of water*. Just say what you know: *The rat has had no water to drink for several hours, and the temperature is 90 degrees Fahrenheit*.

This applies not only to Rudolph the Rat but also to your pet guppy, Rover, and the 6-month-old child crying in the apartment next door. None of them have language. None expect, know, or think. Of course, the typical 6-month-old child, and hopefully the autistic child, will learn to speak and will learn to think and expect and will come to know. But not yet. In fact, often, if not usually, you can't even make these inferences about any particular behavior of a verbal human being either, as Sid's scratching shows.

Don't say this, don't say that; give us a break. What can *we say?*

Well, our set of *don't says* is more than a mere abstract, intellectual nicety. All those taboo words get in the way of your really understanding what's going on. And really understanding is important. Suppose you're working with a nonverbal autistic child, as many of you may be doing at some point. And suppose the child has some nasty behavior, like biting you and pulling your hair or screaming or crying uncontrollably. Or suppose he really needs to learn a skill, such as talking. You need to figure out what contingencies are controlling his behavior or failing to control his behavior. And then you need to design contingencies that will help him acquire a functional repertoire, a useful set of skills. Discussing his problem in terms of knows, thinks, wants, and so on will just slow you down and may prevent your helping the child at all. Now, you'll find it about as hard to get yourself to stop using these confusing words as it is to get the child to stop screaming and crying. But, if you do stop, you will find it much easier to discover the reinforcement contingencies that are harming the child and to implement reinforcement contingencies that will help the child acquire a functional repertoire. We're talking serious stuff here.

All these extra words represent the error of circular reasoning and reifications, the major sins of psychologists.

However, once children learn to talk, they have the tools to *expect*, *know*, and *think*. But the analysis of those behaviors is so complex and so controversial, we won't even begin to touch on them until Chapter 24 of this book. In the meantime, wash out your mouth with soap whenever you use *expect*, *know*, *think*, or any of the following similar sorts of expressions like *figures out*, *in order to*, *trying to*, *makes the connection*, *imagines*, *associates*, *learns that*, or *understands*, with a nonverbal human being or nonhuman animal, and *wants* with anybody, at least when doing behavioral analyses. That leads us to the **don't say rule**.

And as you cruise through *PoB*, you learn more and more about what you should say, as a behavior analyst; but we don't have a *do say rule*!

Definition: GENERAL RULE

The Don't Say Rule

- With nonverbal organisms, don't say
- *expects*
- *knows*
- *thinks*
- *figures out*
- *in order to* (or *so that he, she, or it could . . .*)
- *tries to*
- *makes the connection*
- *associates*
- *learns that*
- *imagines*
- *understands*.
- With any organisms, don't say *wants*.

QUESTIONS

1. What are the 12 verbs and expressions you shouldn't use with nonhuman animals and nonverbal human beings?
2. Give an example of how each can be misused.
3. Give an example of how to say the same thing without having to wash your mouth out with soap.

Reinforce Behavior, Not People

Dawn doesn't reinforce Sid. Instead, she might unintentionally reinforce his pouting. She also might reinforce his smiling by smiling back at him. We often lose focus when we talk about reinforcing people rather than some specific class of responses, like pouting or smiling. For example, you don't *reinforce the child for being creative*. Instead, you *reinforce the child's creative behavior*. And, hopefully, that statement will lead you to figuring out the specific behaviors that you consider creative so you can actually reinforce them, rather than vaguely talking about reinforcing people and doing nothing. The secret to understanding how the behavioral world works is always to focus on the behavioral contingency—not the behavior by itself, not the reinforcer by itself, but the contingency. So stay sharp, don't lose focus. A deal? Using *reinforce* correctly will put you ahead of 95% of the professional behavior analysts. Keep an eye on your professor and see how sharp he or she stays. Keep an eye on us, too. And don't reinforce any of us when we don't deserve it. Right?

Definition: GENERAL RULE

Reinforce behavior

- Reinforce behavior,
- not people.

Of course, a more general version of this rule is *reinforce behavior, not organisms.** In other words, we also don't reinforce rats, pigeons, monkeys, and so on, just their behavior; but *organisms* sounds so pompous.

QUESTION

1. We just snuck a tiny joke into the last few sentences; so tiny that only 15% of our students got it. Hint: We violated our own rule. OK? Now, please explain it.

Compare and Contrast

REINFORCER VS. REINFORCEMENT

What's wrong with this sentence? *The shocked look on his sister's face was the reinforcement for his telling the dirty joke*. Hint: The word *reinforcement* is wrong. So what word should you use? *Reinforcer*. The shocked look is a *reinforcer*, not a *reinforcement*. Remember: The *reinforcer* is the stimulus that will increase the likelihood of responses it follows. The sister's looking shocked is the event that reinforced telling the dirty joke.

Reinforcer = thing, event, change of conditions
Reinforcement = the delivery of the reinforcer and the resulting change in behavior

Then how does *reinforcement* fit into the picture? *Reinforcement* describes the whole scene. *Reinforcement* is what took place. Remember: ***Reinforcement*** is the process or procedure of reinforcing a response. *Reinforcement* occurred as the boy told the dirty joke and his sister's mouth fell open, her head jerked back, her face turned red, and her whole body stiffened. Of course, we'll only know for sure that reinforcement occurred if the boy increases his frequency of shocking behavior.

In other words, we can use *reinforcement* to describe that a reinforcer followed a response and now that response occurs

* We also punish behavior, not people.

more frequently. *Reinforcement* refers to the whole process, and *reinforcer* refers to one component in that process.

Many people, even pros, say *reinforcement* when they should say *reinforcer*. But that's no excuse for you. Be sharp.

QUESTIONS

1. What's the difference between *reinforcer* and *reinforcement*?
2. Correctly use *reinforcer* and *reinforcement* in the same sentence.

A FEW MORE COMMENTS ON REINFORCEMENT

I make a big deal out of how soon the reinforcer must follow the response for reinforcement to occur. I do so to distinguish between *reinforcement contingencies* and *analogs to reinforcement* contingencies, as we'll discuss in Chapter 25. With verbal human beings, sometimes a reinforcer will follow the response by several days, and yet, as a result, the response will occur more frequently in the future. We will argue that this is an analog to reinforcement and not true reinforcement.

Another point: Instead of just *presentation of a reinforcer*, we would be more precise to say *presentation or increase in a reinforcer*. For example, suppose you're sipping a soda through a crimped straw. Well, the presentation of that sugar-filled soda into your mouth is reinforcing the sipping response. So, *you have no soda* ⇒ *you sip* ⇒ *you have soda* is a positive reinforcement contingency. But also suppose your straw has a crimp in it, so that the soda's not flowing as rapidly as it might. You straighten out your straw and get rid of the crimp; now you have an increase in the reinforcer, the flow of the soda into your mouth. So, *you have slow flow* ⇒ *you straighten straw* ⇒ *you have fast flow*. That's another positive reinforcement contingency, this time based on an increase in the amount of the reinforcer, not the mere presentation of it.

And suppose Dawn increases her attention to Rod when he cries; perhaps at first she was only looking at him, but now she picks him up, caresses him, and talks to him. Rod is getting more of a reinforcer, and that increase in the reinforcer should reinforce crying. Just to keep life simple, we won't put *increase* in the formal definition of positive reinforcement contingency, but you should understand that it's implied.

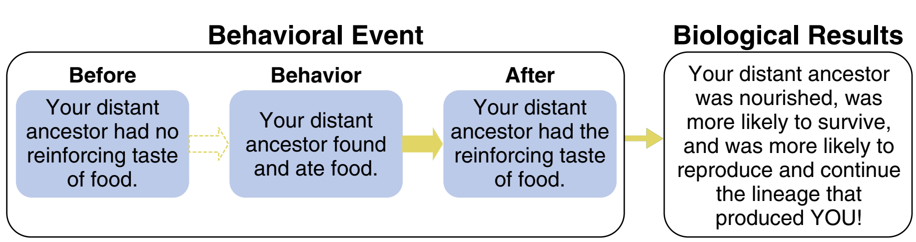
Another point: The effects of past reinforcement can be seen when the current occasion for the response is similar to the occasions when the response has been reinforced in the past. So the child's temper tantruming will be more likely to occur only when Dad's around, if those are the only occasions when tantruming has been reinforced in the past (Chapter 14).

And a final point: Incidentally, we talk about a *reinforcement contingency* wherein the response caused the reinforcer to occur; as a result, the future frequency of that response increases. But suppose the reinforcer accidentally followed the response a time or two, but the response didn't cause the reinforcer to occur. In other words, it was just by accident that the reinforcer happened to follow the response. Would the reinforcers accidentally following the response also increase the future frequency of that response? Would reinforcement have occurred? Yes. The important thing is that the reinforcer promptly follows the response. All a contingency does is guarantee that the reinforcer will promptly follow the response often enough that you will get a significant increase in the frequency of the response. The contingency is just a practical way of making sure you reinforce what you want to reinforce. In Chapter 21, we'll talk about *superstitious behavior* resulting from such accidental contingencies.

So, if we were to be exhaustingly exhaustive we might use the following definition: **Positive reinforcement contingency**: the presentation or increase of a reinforcer promptly following a response resulting in an increased frequency of that response on similar occasions and with similar motivation operating.

BIOLOGICAL EVOLUTION AND REINFORCERS

Life is full of stimuli, events, activities, and conditions that help us (they nourish our body's cells or help our population survive). Fortunately, most animals, including the human animal, have evolved so that many of those biologically helpful stimuli also act as reinforcers. For example, we tend to repeat acts that produce food, water, and sex. Eating food and water help us as individuals to survive. Sexual intercourse helps us as a species to survive.



Sex is fun for us as individuals, but it doesn't help us as individuals. We have evolved in such a way that food and water are reinforcers because consuming food and water has allowed individuals to survive long enough to produce and raise offspring. The reason we have evolved in such a way that sexual stimulation is a reinforcer is that the resulting sexual stimulation has caused individuals to copulate and thus produce offspring.

Unfortunately, not all beneficial stimuli are sufficient reinforcers for many of us. For example, most adults (and an alarming number of kids) in the United States fail to find the stimulation from physical exercise much of a reinforcer. So they fail to do the exercise needed to keep their bodies in good shape.

And, unfortunately, not all reinforcers are good for us, at least in the quantities many of us now consume. Salt, simple, processed sugar, and trans fats are examples. "I'll have a fudge sundae after I finish these nachos." Or you can trash yourself big time by having a cup of coffee with cream and sugar as you finish off your cigarette. Harmful reinforcers have become so prominent in our modern world that I've adopted this policy:

If it feels too good, be careful. 'Cause it'll likely sneak up from behind and bite your butt.

QUESTION

1. Please give the following examples:

a. a reinforcer that is helpful for you
b. a helpful stimulus that is not a reinforcer
c. a reinforcer that is harmful

Notes

1 This is an easy, fun, worthwhile read. Try it; you'll love it. Mager, R. F., & Pipe, P. (1997). *Analyzing performance problems: or, you really oughta wanna—How to figure out why people aren't doing what they should be, and what to do about it* (3rd ed.). Atlanta: CEP Press.

2 U.S. Bureau of Labor Statistics. (2020, July 7). *Table A-2: Employment status of the civilian population by race, sex, and age*. Retrieved from www.bls.gov/news.release/empsit.t02.htm

3 Sheats, K. J., Irving, S. M., Mercy, J. A., Simon, T. R., Crosby, A. E., Ford, D. C., . . . Morgan, R. E. (2018). Violence-related disparities experienced by Black youth and young adults: Opportunities for prevention. *American Journal of Preventative Medicine*, *55*(4), 462–469.

4 Bureau of Justice Statistics. (2018, January). *Prisoners in 2016*. Retrieved from www.bjs.gov/content/pub/pdf/p16_sum.pdf

5 Riddell, C. A., Harper, S., & Kaufman, J. S. (2017). Trends in differences in US mortality rates between Black and White infants. *JAMA Pediatrics*, *171*(9), 911–913. doi:10.1001/jamapediatrics.2017.1365

6 University of Michigan Poverty Solutions. (2016). *Poverty facts*. Retrieved from www.npc.umich.edu/poverty/

CHAPTER 7

Negative Reinforcement

Behavior Analyst Certification Board 5th Edition Task List Items		
A-2.	Explain the philosophical assumptions underlying the science of behavior analysis (e.g., selectionism, determinism, empiricism, parsimony, pragmatism).	Pages 110–111
B-2.	Define and provide examples of stimulus and stimulus class.	Pages 105–106
B-4.	Define and provide examples of positive and negative reinforcement contingencies.	Page 107 and throughout
B-7.	Define and provide examples of automatic and socially mediated contingencies.	Page 108 and throughout
B-13.	Define and provide examples of rule-governed and contingency-shaped behavior.	Page 121
F-7.	Conduct a descriptive assessment of problem behavior.	Pages 113, 115
G-1.	Use positive and negative reinforcement procedures to strengthen behavior.	Page 107 and throughout
G-2.	Use interventions based on motivating operations and discriminative stimuli.	Page 116
H-4.	When a target behavior is to be decreased, select an acceptable alternative behavior to be established or increased.	Page 109

Concept

NEGATIVE REINFORCER (B-2)

In Chapters 2 and 6, we defined *positive reinforcer* as stimulus that increases the future frequency of a response it follows. Now, check out this parallel definition of **negative reinforcer**.

Definition: CONCEPT

Negative reinforcer (aversive stimulus)

- A stimulus
- that increases the future frequency of a response that
- its **removal (termination)** follows.

The only difference between the two stimuli is that we're talking about the stimulus (event, activity, or condition) being *removed*, rather than *presented*.

Concerning the *stimulus*, *event*, *activity*, or *condition*, we will use those four terms somewhat interchangeably, depending on the context. The traditional term, *stimulus,* sometimes seems limiting and strained. For example, making a fool of yourself in public would be an *aversive event*, but it seems awkward to call making a fool of yourself an *aversive stimulus*. And for most English-speaking people, being too hot seems more like a *negative reinforcer* than an *aversive stimulus*. So the terminology ain't perfect in the English language, but I haven't sunk to the common practice of using adjectives as nouns, like treating *aversive* as if it were a noun (for example, *I escaped an aversive*).

And as a reminder, behavior analysts often use the term *negative reinforcer* where regular people might use *unpleasant* or *aversive stimulus*. The two expressions mean about the same thing. So when you're talking to behavior analysts, use *negative reinforcer* or you'll lose two cool points; but when you're talking to regular people, for example, your parents or your client, use *aversive stimulus*, unless you just want to impress them and don't care how much you confuse them. As we've said, *negative reinforcer* sounds like a self-contradiction, an oxymoron.

We find it helps to think of positive reinforcers as something we tend to maximize contact with and to think of negative reinforcers as something we tend to minimize contact with. And one way you can minimize contact with a negative reinforcer is to make responses that have escaped that negative reinforcer in the past.

Life is full of stimuli that are harmful for us (they will damage our body's cells). Fortunately, most animals, including the human animal, have evolved so that many of those biologically harmful stimuli are also psychologically negative reinforcers. We tend to minimize immediate contact with high and low temperatures, loud sounds (unless we call it rock and roll), bright lights, painful stimuli that can cut or bruise us, and spoiled food that has an aversive odor (a negatively reinforcing odor). It's only because of much social pressure that we overcome the negatively reinforcing taste of other harmful substances and manage to become addicted to them, such as alcohol, nicotine, and coffee. And once we become addicted, alcohol, nicotine, and caffeine lose their negatively reinforcing properties.

Unfortunately, not all harmful stimuli or conditions are negative reinforcers, even before we become addicted. For example, many of us fail to minimize, or at least moderate, contact with salt, processed sugar, and trans fat—all substances that can harm our bodies when consumed in typical American quantities. The gum- and tooth-destroying plaque that accumulates on our teeth often fails to be a negative reinforcer—we don't minimize contact, contact of the most intimate sort, with it. And the thrilling stimuli resulting from driving a car faster than we should are often not as aversive as they should be. We human beings have changed our world more rapidly than we can biologically adapt to it. We can no longer depend on our animal nature to steer us away from harmful stimuli, events, and conditions.

Life is also full of stimuli, events, activities, and conditions some people find negative reinforcers, though they are generally helpful, like exercise and flossing our teeth, not to mention cleaning up our room.

QUESTIONS

1. *Negative reinforcer*—define it.
2. Give an example of
   a. a negative reinforcer harmful to you
   b. a harmful stimulus that is not a negative reinforcer
   c. a negative reinforcer that is not harmful

"Aversive" vs. "Adversive"

By the way, notice the term we're using is *aversive*, not *adversive*. *Adversive* is not a word* and *aversive* is a word only because psychologists coined the term. *Aversive* is a cousin of *aversion*, which means "intense dislike." Ed, from Chapter 2, has an *aversion* for Dr. Yealland's electric shock. He dislikes the shock. He finds the shock *aversive*.

But *dislike* is not a reliable criterion. For example, people may claim to dislike seeing swimmers chased by sharks and then go out of their way to see the movie *Jaws*, at least your parents did. So, to be safe and to get more reliable results, behavior analysts don't use the commonsense dislike as their criterion for whether a stimulus is a negative reinforcer. Instead, they use our formal definition: They ask if a condition will increase the future likelihood of a response if the condition is terminated after the response. Put more simply, we say a condition or stimulus is a negative reinforcer if its termination reinforces an escape response. By that criterion, Dr. Yealland's electric shock was a negative reinforcer.

Along the same lines, suppose something makes you feel bad or sad. Is that something or that feeling a negative reinforcer? Maybe, perhaps often—but not always. Again, many people plopped down many dollars to see *Titanic* so they could cry their eyes out. And again, the only way we can be sure is to go back to our formal definition and ask: Does termination of this particular sad feeling reinforce the response that terminates it? If not, then we don't have a negative reinforcer, no matter how much we cry.

QUESTION

1. You should be so hyped up about how dumb it is to use "adversive" that you'd spot it immediately on a written quiz and get full credit for correcting it. And, of course your sly but caring instructor might occasionally slip an "adversive"

* *Adversive* is not a word, but *adverse* is a word. It is an adjective meaning acting against or in a contrary position. But in any case, *aversive* is the word we want here, not *adversive* and not *adverse*.

into her or his lecture, just to give you an opportunity to correct it. When that happens, feel free to blurt out, "I heard the really dumb thing you said!" She will probably be so impressed she'll offer you a full-ride assistantship on the spot.

Concept

NEGATIVE REINFORCEMENT CONTINGENCY (ESCAPE CONTINGENCY) (B-4)

We've been discussing *negative reinforcer*, a fundamental concept of behavior analysis. Now let's formally introduce the ***negative reinforcement principle***: *A response becomes more likely if it has removed or reduced a negative reinforcer in the past*.

Definition: CONCEPT

Negative reinforcement contingency (escape contingency)

- The response-contingent
- removal of
- a negative reinforcer
- resulting in an **increased** frequency of that response.

This is a form of reinforcement—reinforcement by the removal of an aversive stimulus, a negative reinforcer.* And the procedure involved is a **negative reinforcement contingency (escape contingency)**.** (Note that the more immediate the removal of the negative reinforcer, the more effective the negative reinforcement contingency.)

And remember:

Response = Behavior

Here's the strongest example of a negative reinforcement contingency I've ever personally experienced: Years ago, in my decadent days of cigarette smoking, I was driving with a friend through rural Ohio late at night. I pulled out a pack of cigarettes, stuck one in my mouth, pulled out a pack of matches, struck one, and yeeooww! A spark from the match hit the cornea of my left eye—the most pain I've ever experienced!

We sped through the Ohio night in desperate search of a town large enough to have a physician. I was crying because of the pain and because of the certainty that I would lose my left eye. Finally, we found a hospital and rushed into the emergency ward. The physician on duty laid me down on the examination table, put a drop of butyl sulfate in my eye, and immediately the pain disappeared and my eye was perfect. I thought that physician, with his magic drops, was God. You can bet your bottom dollar that if I ever get a spark in my eye again, I'm going to rush to Ohio in search of that physician and his magic drops. Talk about negative reinforcement—wow!

Yealland's shock removal reinforced leg movements. The pain removal by the physician in Ohio reinforced lying on the examining table and gamely trying to hold open my left eye. Reducing an itch reinforces scratching. Reducing bladder pressure reinforces getting up in the morning and going to the bathroom. Escape from the drip, drip, drip reinforces blowing your nose. The contingent removal of various aversive stimuli reinforces many of our crucial everyday actions.

Some additional real-life examples found driving to class: Reducing the unbearable heat in your car reinforces rolling down the window or turning on the A/C. Stopping the annoying beeping sound reinforces buckling up. The same holds true with turning off your headlights to stop the

* Instead of saying ***removal*** of a negative reinforcer, we'd be more precise to say ***removal or reduction*** of a negative reinforcer. For example, suppose the temperature is 90° and you turn on your funky air conditioner that reduces the temperature only to 80°. Well, the reduction of that negative reinforcer from 90° to 80° reinforced your turning on your air conditioner, even though you were not able to completely remove the aversive heat. So, *you're suffering a* 90° *temperature* ⇒ *you turn on your air conditioner* ⇒ *you're suffering only an* 80° *temperature*. That's an escape contingency based on the reduction, not the removal, of a negative reinforcer. As with our definition of *reinforcement contingency*, just to keep your life simpler we won't put *reduce* in the formal definition, but you should understand that we're always implying it. Also, we could attach similar footnotes to the remaining six contingencies we present in later chapters; however, just to keep your life simpler, we won't, but you should understand that we're implying them.

** Note to the students: we sometimes repeatedly put terms in parentheses; for example, sometimes I write *negative reinforcement (escape)* rather than just *negative reinforcement* with the hope that you will become fluent with both ways of speaking.

beeping after you turn off your car. Other examples include groggily swiping the snooze button when your alarm goes off, tightening the faucet to stop that annoying dripping sound, and shifting positions when your limbs fall asleep. We engage in all these behaviors daily, all controlled by negative reinforcement contingencies. (By the way, we'll be hitting the concept of learning without awareness in a few pages, and many of these are examples where the contingency may control our behavior, yet we are completely unaware that we're even doing the behavior, let alone that the negative reinforcement contingency is controlling that behavior.)

QUESTION

1. *Negative reinforcement contingency*—define it and diagram an example.

Example of Negative Reinforcement (Escape) Behavioral Clinical

THE GOIL WITH THE DOITY MOUTH[1]

The beauty of Grace's thin, 19-year-old face was enhanced by the contrast between the pale skin she had inherited from her German-Swiss father and the dark eyes and hair she had inherited from her Mexican mother. Her mother's family was dining with her family, and they all chatted and laughed gaily, chili peppers spicing the food and recorded, high-intensity mariachi trumpets spicing the talk and laughter. Everyone was having a great time. Everyone but Grace. She could feel it coming.

Grace stood abruptly. Her body became rigid. The talk and laughter stopped. Silence, except for the mariachi band. Now the whole family could feel it coming.

Grace's clenched fists flew to her collar bones. The fists stayed there, rigid, vibrating back and forth. Her face grimaced. Her lips twisted to the left. From her mouth came the sound "f-f-f-f" merging into "uck."*

Grace's body relaxed. She sat back down. No one said anything. No one ate. Then her father said, "That's all right, Grace. You can't help it."

Grace stood again. This time more slowly. "I hope you'll excuse me. I don't feel too well." She went to her room, lay down on her bed, and cried. Now the house was as silent as a deathwatch. No mariachi trumpets, no talk, no laughter—just Grace's quiet weeping.

The reason for Grace's tears was not that she had ruined the family dinner. This had happened often. The family could cope. She thought she already heard the sound of forks discreetly clicking against the dinner plates, as the family began, again, to eat the enchiladas and refried beans.

Grace cried because she knew she would ruin her wedding ceremony. She knew she would break out in a full-blown display of the Gilles de la Tourette syndrome, right in the middle of the wedding ceremony, as she had at dinner. The wedding ceremony was just the kind of stressful occasion that caused the display. Then that awful word would come out of her mouth. And that would be the last she would ever see of Greg—the man she loved more than anything else in her life—the only good thing that had ever happened to her.

Grace cried, but she didn't give up. She never gave up. She had always had to work extra for what her friends took for granted. Nothing had ever been easy for Grace. Not from the day she was born. She had been a "blue baby," with a defective mitral valve, the valve that controls the flow of blood from the auricle to the ventricle chambers of her heart. In parochial school, the nuns treated her as much like a typical child as they could. But her mother had to come to the playground at every recess to make sure she did not overexert herself or to take care of any emergency that might arise.

At the age of 11, Grace had a successful heart surgery, but the physicians told her she should never exert herself. She largely ignored their advice, doing the best she could to live a normal life. Her classmates accepted her spasms as something beyond her control and just gave her the Chicagoesque nickname of "the goil with the doity mouth." At the age of 17, she had gone to the famous medical school at Johns Hopkins University for further diagnosis and treatment. But nothing had changed. Nothing, except one thing. She had met Greg on the flight back from the hospital to her home.

Now Grace was 19. Her lips and nails were bluish, because of poor blood circulation. And her phalanges, the bones in her fingers and toes, were slightly enlarged and bulb like. She was going to college. She and Greg planned to get married. And she would do anything to prevent her Tourette syndrome from spoiling that. She would even go back to the university hospital.

* We apologize for this profanity, but this is true to the actual case, and we thought it was important for you to understand the seriousness of this problem.

Intervention (H-4)

Fortunately for Grace, on her return to the hospital, psychiatric services assigned her to psychologist Dr. Israel Goldiamond. He worked on her case with Dr. Sheldon Glass, who was doing his psychiatric residency in that hospital. They designed a behavior-analytic intervention.

"Doctor," Grace asked, "does my problem have anything to do with a death wish?"

"What makes you ask that?" Could there be something to this death-wish nonsense, so popular with traditional psychoanalysts?

"Every time I say something like 'this will be the death of me,' all the doctors look at each other significantly, and make notes in their notebooks."

The behavior analyst smiled. "I wouldn't worry too much about that one, Grace. Instead, why don't you tell me more about what happens before you display the syndrome and what happens afterward."

"Well, I have my attacks when things get too stressful. Like when the Mexican side of our family comes to visit. They're so much noisier than the Swiss side of my family."

"Grace, you sound almost racist. Don't you like Mexicans?"

"I don't mean to be racist. And I love my family. It just . . . Oh, I don't know . . ."

"OK, let me see if I understand. Your reactions may result from living in a racist environment, where Mexican Americans are discriminated against. And that may make you too sensitive to racial and cultural stereotypes. In any event, you're having trouble coping. So, at least to you, your mother's family seems noisy. And at the least, you find that aversive. And . . ."

"Yes, it's horrible. It upsets me so much that I have an attack and start twitching, and you know."

"And then what happens?"

"I guess everyone gets quiet, and I leave the room."

"Why don't you just ask them to be a little less noisy?"

"I do, but they don't listen to me."

"OK, why don't you try this? Tell them your doctors have said noise and excitement will harm your condition, and then say you sure would appreciate it if they would be a little quieter."

"They'll never listen to me."

"But didn't you say the other day that the Mexican side of your family is especially fond of children? And didn't you say they're generally concerned about other people?"

"Well . . . yes."

"So?"

"Sooooo, maybe you're right. Maybe they would quiet down if they understood that it was important for my health. Of course, they would. I know they would. You're right. I'll do that. I'll explain it to them."

"Great. And at our next meeting, we'll discuss ways you can reduce the stress in other situations."

The behavior analysts also spent two sessions helping Grace acquire a milder form of her tic, so that when it did occur, it would be much less disruptive. The results? Grace married right on schedule. No problems. No syndrome. No embarrassing swearing disrupting the sacred ceremony. And like 50% of the normal American couples who get married, a few years later Grace and Greg divorced, right on schedule. Only rarely did the Tourette syndrome recur, and then in a much milder form. Fifteen years after the behavioral intervention, Grace was holding down a regular job as an administrative assistant.

Analysis

UNDESIRABLE BEHAVIOR MAINTAINED BY REINFORCEMENT BY THE REMOVAL OF A NEGATIVE REINFORCER (G-1)

Sid's Seminar

Sue: Is that it? Is that all Goldiamond and Glass did to help Grace?

Sid: That's it. That's all they needed to do. And now, because I'm the teacher, I get to ask a few questions, too. First, how does Grace's problem relate to the topic of this section—negative reinforcement?

Tom: I know the answer you want, but I doubt if it's true. You think Grace is having her attacks so she can escape from aversive situations, ah . . . from the negative reinforcers, like the relatives she thought were too noisy. That seems far-fetched to me.

Joe: Doubting Thomas, I wouldn't put it like that. When you say, "So she can escape," it sounds like she's doing it on purpose. I don't think she meant to exhibit the Gilles de la Tourette syndrome. **I think she wasn't even aware of the contingency between those episodes and her escape from the negative reinforcer**. It's as if the reinforcement contingency snuck up and grabbed her, without her even knowing it. And before long, she was having these attacks and couldn't do anything about it. And it was all because those attacks allowed her to escape the negative reinforcer. Escape responses without awareness.

Tom: Well then, if her attacks were so helpful for her, why did she want to get rid of them?

Joe: First, she wasn't aware of how helpful they were. And even if she had been, the price was too high. So a big part of the behavioral intervention was helping her acquire more appropriate escape responses—responses that wouldn't disrupt her life so much, that wouldn't humiliate her so much.

Tom: So you're saying the attacks occurred because relief from an aversive situation reinforced them. Then why was she so concerned about having an attack in the middle of her wedding ceremony? That doesn't make sense to me. She wanted to get married.

Sue: Let me answer that one. I'm a married woman. And I went through a big wedding ceremony. And it was the most frightening thing I ever did. It was really aversive. But I wanted to get married, and I also wanted the big ceremony. But when I was in the middle of it, I was shaking so badly I could hardly walk down the aisle. Aversive is the word all right. It's . . .

Joe: Yes, what's going on here is . . .

Sue: Now, Joe, let me finish. If Grace were deciding rationally, she would decide to put up with the aversiveness of the ceremony to marry Greg. But she's not deciding rationally. She's not even deciding irrationally. She's not deciding. The negative reinforcement contingency just gets ahold of her behavior and produces the attack. So the immediate reinforcement of escape from the negative reinforcer might win out over the long-range reinforcer of a marriage with Greg, especially since she's not constantly thinking about Greg. (To see why this is the case, make sure to read our rule-governed behavior chapters toward the end of the book, where we discuss small but cumulative outcomes for behavior.)

Sid: Let me summarize your behavior analysis like this: Immediate escape from a negative reinforcer (family commotion) reinforced an inappropriate response (attacks). This unfortunate reinforcement could occur without the person's being aware of the contingencies of reinforcement. This reinforcement might maintain that escape response (attacks), though that response would have undesirable long-range outcomes (a less reinforcing and more humiliating life). And this reinforcement might maintain that escape response, though the person is aware of those undesirable long-range outcomes. Excellent analyses. Excellent class discussion. One point for Sue, one for Joe, and one for Tom.

Tom: Why me? I didn't agree with the party line.

Sid: No, but you knew what the party line was, and you presented a thoughtful, well-reasoned critique. I want to reinforce careful analysis, no matter what you conclude.

Tom: Then, Mr. Fields, you probably should present your points immediately after the analysis rather than at the end of the seminar. Or, you should say you want to give reinforcers for careful analyses and omit the misuse of "to reinforce" for the delayed delivery of reinforcers.

Sid: OK, then, Tom, let me give you one cool point, because you corrected my use of a technical term. Class dismissed.

As he walked out of the classroom building into the blinding sun, Sid put on his sunglasses—a desirable automatic, negative reinforcement (escape) contingency, of which he was not even aware. And then itchy Sid started scratching an eczema rash on the back of his left hand—an undesirable, automatic negative reinforcement contingency.

QUESTION

1. Give an example of an unacceptable behavior maintained by a negative reinforcement contingency and show how you might get rid of the bad behavior by substituting a more acceptable alternative escape response.
   - What is the unacceptable behavior?
   - What is the negative reinforcer?
   - What do you think would be the undesirable outcome of that behavior?
   - What is the acceptable alternative response?
   - What is the role of awareness in all this?

THE TOOTHPASTE THEORY OF ABNORMAL BEHAVIOR (A-2)

Concerning Tom's concern about the negative reinforcement interpretation of Grace's Tourette syndrome: He probably was making a common mistaken assumption—that her abnormal behavior reflected some inner psychic force that had gone haywire and forced this abnormal behavior out of her. Most people in our culture, including most psychologists, seem to look at abnormal behavior as something that issues forth from a person like toothpaste squeezed from a tube. They know, somehow, that an inner pressure builds inside the person, forcing out the behavior.

The Toothpaste Theory of Abnormal Behavior*

- Abnormal behavior flows out of sick people
- like toothpaste squeezed out of a tube.
- Abnormal behavior results from inner psychic pressure.

People often fall back on the toothpaste theory to account for unusual behaviors of children with autism, like Jimmy's disruptive and aggressive behavior. They say, "He's expressing an inner hostility that needs to come out." Watch out whenever anyone talks about "expressing" anything, like expressing anger or even expressing love. This toothpaste view always distracts us from looking for the contingent presentation of positive reinforcers and termination of negative reinforcers that actually control the behavior.

The invention of this inner psychic force is an explanatory fiction. A much more parsimonious explanation is in terms of the principles of behavior that are empirically established and seen to function everywhere, for example, the principle of negative reinforcement.

QUESTION

1. Please say a little bit about why the principle of *negative reinforcement* is so much better an explanation of Grace's behavior than the common notion that she's releasing a built-up pressure.

Compare and Contrast

REINFORCEMENT BY THE PRESENTATION OF A POSITIVE REINFORCER VS. REINFORCEMENT BY THE REMOVAL OF A NEGATIVE REINFORCER

The two types of reinforcement produce the same results—an increased response frequency. But one procedure increases the response frequency by the contingent presentation of a reinforcer and the other by the contingent removal of a negative reinforcer.

Suppose the radio is playing your favorite song. But the volume is so low that you can hardly hear it. You turn up the volume. The louder sound (reinforcer) reinforces turning up the volume (response).

Before	Behavior	After
The volume is too low for you.	You turn up the volume.	The volume is perfect for you.

But now suppose your sister's stereo is almost blasting you out of the house. Then you turn down the volume. Here the reduction of the sound (removal of a negative reinforcer, relief) reinforces your turning the volume down (escape response). Each response would be more likely to occur the next time the proper occasion arose.

Before	Behavior	After
The volume is too loud for you.	You turn down the volume.	The volume is perfect for you.

Suppose, you're watching *Halloween XII*, and a scene comes on the screen that is too violent. You close your eyes. No longer viewing the aversive event (removal of a negative reinforcer, relief) reinforces closing your eyes (response). Again, in similar circumstances, you will be more likely to close your eyes in the future. So this is a negative reinforcement contingency.

Before	Behavior	After
You see an aversively violent scene.	You close your eyes.	You don't see an aversively violent scene.

You're sitting at your desk completely engrossed in *Principles of Behavior*. You haven't eaten for a few hours. You are sharing your desk with a huge bowl of popcorn. After a few minutes, you notice all the popcorn has disappeared. But there's no one else in your room. Our guess is that the taste of the popcorn in your mouth reinforced your responses of taking an occasional bite of that nutritious food, though you may have been largely unaware that you were making those responses. Positive reinforcement.**

* Note that this definition is not in one of our formal definition boxes. That means that it will definitely not be on any of the BACB exams, unfortunately.

** What about our classic example—Rudolph presses the lever and gets a drop of water. Reinforcement by the presentation of the water reinforcer or escape from aversive thirst, from aversive dehydration? Traditionally, we behavior analysts have considered this as an example of reinforcement by the presentation of the

The following contingency table summarizes all this. Here's how you read this particular one: First, read one of the cells (boxes) from the row across the top, then a cell from the column along the left, and finally, the matching cell in the center. So you might select *Present* and *Reinforcer*. The corresponding cell in the center is "Positive reinforcement." This means: *If you* ***present*** a ***reinforcer****, you call the contingency* ***positive reinforcement***, and the frequency of the behavior increases (⇑). *Or if you* ***remove*** *a* ***negative reinforcer****, you call the contingency* ***negative reinforcement*** and the frequency of the behavior also increases. And, instead, you can go from the inside to the outside of the table: If you want to increase the behavior (⇑), you can use either a positive reinforcement contingency, with which you present a reinforcer, or an negative reinforcement contingency, with which you remove a negative reinforcer.

Contingency Table (preliminary #1.1)

Stimulus	Present	Remove
Positive Reinforcer	Positive Reinforcement ⇑	Go to Chapter 9
Negative Reinforcer	Go to Chapter 8	Negative Reinforcement ⇑

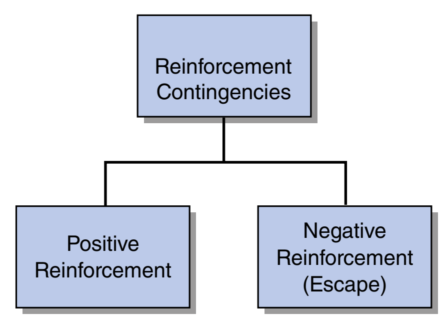
Here's another form of essentially this same table; some instructors prefer this one.

You can read it this way: If you present a stimulus (a cell from the row across the top) and the response frequency increases (a cell from the column along the left), then you have a positive reinforcement contingency (corresponding inside cell), which you can also call *reinforcement by stimulus addition* (S^{R+}). For example, if you ***present*** food and the lever-press frequency increases, you've got positive reinforcement (S^{R+}).

Similarly, if you remove a stimulus (a cell from the row across the top) and the response frequency increases (a cell from the column along the left), then you have a negative reinforcement contingency (corresponding cell), which you can call *reinforcement by stimulus subtraction* (S^{R-}), or *negative reinforcement*.* For example, if you ***remove*** electric shock and the lever-press frequency increases, you've got negative reinforcement (S^{R-}). Contingently presenting food is *positive reinforcement* and contingently removing electric shock is *negative reinforcement*.

Contingency Table (preliminary #1.2)

	Present Stimulus	Remove Stimulus
Response Frequency Increases ⇑	**Positive Reinforcement Contingency** Reinforcement by stimulus addition (S^{R+})	**Negative Reinforcement Contingency (Escape)** Reinforcement by stimulus subtraction (S^{R-})
Response Frequency Decreases ⇓	Go to Chapter 8	Go to Chapter 9



Note: Remember, when behavior analysts just say *reinforcement,* they usually mean *positive reinforcement*, sort of an abbreviation. And when they're talking about negative reinforcement, they usually say the whole thing, *negative reinforcement*, or they may say *escape*.

water reinforcer, because the water is the thing we directly deal with, not the thirst. But students typically think of the thirsty guy crawling across the parched desert, crying *water*, clearly suffering, clearly the place for a negative reinforcement contingency. So that's a gray area.

* My students strongly prefer the first version of this table, the simpler version. Me too. But if they ever plan to leave my protective custody and mingle with other instructors, they might do well to get familiar with the second table also. Incidentally, Julie Vargus commented that her father, B. F. Skinner, regretted introducing the terminology *positive* and *negative reinforcement* because so many people confuse *negative reinforcement* with *punishment*.

QUESTIONS

1. Compare and contrast positive and negative reinforcement, illustrating your points with an example.
2. Construct the contingency table (preliminary #1.2) and explain it.

Warning: Whenever you see a table in the text, there's a good chance you'll see a blank table in the quiz and you'll be expected to fill it in. But that's not all: The blank table might be rearranged, so you have to really understand it; rote memorization won't cut it.

Functional Assessment
Behavioral Special Education

JIMMY, THE CHILD WITH AUTISM[2]—PART II

Jimmy Lewis was 3 years old and had the IQ of a 6-month-old. He had little to no spoken language, couldn't dress himself, and wasn't toilet-trained. He often had tantrums. Sometimes he pulled his hair out and banged his ear with his fists. He showed no love or affection. He seemed happiest when they just left him alone to sit all day, spinning his toy top.

Mae Robinson knew the only interventions that had reliably helped autistic children were behavioral interventions. So, while she searched through her behavioral journals to find what she could do to best help Jimmy, Mae had Jimmy work with Sue, one of her eager practicum students from Big State University.

Jimmy sat across a small table from Sue, and she placed three common objects on the table, a ball, a doll, and a block. She had been working on this receptive identification procedure with Jimmy for a few days now, with little success. He rarely receptively identified, that is, pointed to the correct object, independently. Sue often had to physically prompt him to perform the correct response during the procedure. The lack of success meant that Jimmy didn't get enough reinforcers. And Sue had been encountering more and more problem behaviors during the last few sessions.

To start the session, Sue presented the first instruction, "Ball." Jimmy did nothing.

"Jimmy, ball." Nothing.

"Jimmy, point to the . . ." But as she began pointing to the ball herself, Jimmy swiped his hand across the table violently, knocking everything onto the floor.

Sue leaned over and picked up the objects. "Jimmy, please don't do that. It's OK." Sue patted him on the shoulder, and sat back for a few seconds to collect herself. "Now, Jimmy, point to the ball." Jimmy tried to swipe again, but Sue blocked his arm. Then he started pounding his fists on the table and screaming.

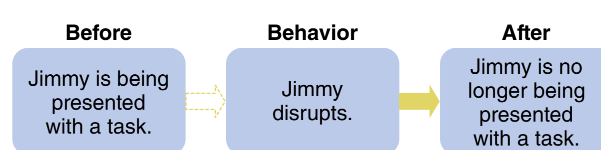
Sue sighed and started cleaning up the materials. "It's OK, Jimmy, let's try working on something else for a while."

Getting Some Data (F-7)

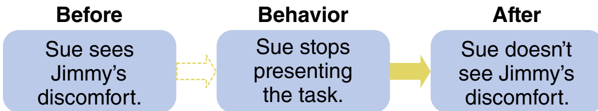
Mae knew she'd need to find the contingencies maintaining Jimmy's disruptive behavior before she could best help him. Therefore, she told Sue that she was going to do a *functional assessment*. Then she sat quietly in a corner, behind Jimmy, so she could observe all the details of the teaching session without disturbing it. She wore an earbud connected to a small audio device fastened to her belt. She held a pencil and a clipboard that contained a ruled form.

The device beeped in her ear and said, "Interval 15." Mae recorded on the form that Jimmy pounded and screamed during that interval. Ten seconds later the recorder beeped again and said, "Interval 16." This time Mae recorded that Sue stopped presenting the work tasks to Jimmy during that 10-second interval. Mae continued observing and recording in 10-second intervals throughout the teaching session. As she continued to observe Jimmy's disruptive behavior, she began to see the contingencies maintaining that behavior.

Right after the session, Mae and Sue evaluated the interaction between Sue and Jimmy. Sue began, "I think I know what you're going to say, Dr. Robinson. You're going to say I negatively reinforced Jimmy's disruptive behaviors by letting him escape the work. And I suppose you're right."



"But it's so hard to sit there and continue working on something he hates so much."



"You are spot on there, Sue," said Mae, "That's just what my **functional assessment** showed."

QUESTION

1. Please present two negative reinforcement contingencies:
   a. One reinforcing the child's disrupting.
   b. One reinforcing the behavior technician's copping out.

FUNCTIONAL ASSESSMENT, NOT JUST A QUICK FIX

"Functional assessment? What's that?" Sue asked.

Definition: CONCEPT

Functional assessment

- An assessment
- of the contingencies responsible for
- problem behaviors.

"Well, Sue, I'm sure you'll agree that we can best figure out how to help Jimmy if we know what's reinforcing his behavior. In the old days, it was thought that behavior analysts would just move in with the giant bag of M&Ms to fix problems and that they could ignore the causes of the problems—the contingencies maintaining the problems behavior. But since Brian Iwata and his colleagues[3] began their work in the 1990s, it has become clear that it helps to understand the problem contingencies. That understanding allows us, for example, to then make the same reinforcer contingent on more appropriate behavior or stop it from occurring after the inappropriate behavior. Finding the problem contingencies is called a **functional assessment**."

In order to discover the contingencies maintaining a problem behavior, behavior analysts often complete a functional assessment of the contingencies that might be maintaining a problem behavior before designing an intervention to eliminate that behavior. In other words, they look for the contingencies that support the problem behavior. There are three ways to do a functional assessment:

Three Functional-Assessment Strategies:

- ***Indirect assessment.*** Talk to the person with the behavior problem and/or those who interact with that person.
- ***Direct observation.*** Observe the person in his or her daily routines for an extended period.
- ***Experimental functional analysis.*** Systematically modify the contingencies that may be reinforcing the problem behaviors.

This last strategy is also simply called a *functional analysis*. **Functional analysis** is a special form of **functional assessment** in which contingencies are experimentally manipulated. Some students erroneously call *all* functional assessment strategies functional analysis, but that's like calling all dogs poodles. All poodles are dogs, but not all dogs are poodles. All functional analyses are functional assessments, but not all functional assessments are functional analyses.

Of course, behavior analysts also use variations on these three strategies of functional assessment when the problem is that the person fails to do the right behavior, though most often they use functional assessment when the person is doing something he or she shouldn't do rather than not doing something he or she should do.

Sue looked up from her favorite principles of behavior text (heh, heh) and smiled. "Oh, I get it. You used the second functional assessment strategy, *observation*, to discover the contingencies reinforcing Jimmy's problem behaviors. Escape from the aversively difficult task reinforced those disruptions."

Mae laid a hand on her shoulder. "Yes, Sue, I think you've got it. And now that we have a good idea what's reinforcing that behavior, we can work on getting rid of it."

By the Way

During this first week with her, Mae saw that Jimmy's problems were at least as bad as his parents had said. She wanted to extend her functional assessment to get more baseline data on Jimmy's problem behavior, but his problems were so serious that more baseline data probably wasn't in his best interests. From a scientific researcher perspective, a large amount of baseline data would be ideal; however, from Mae's science-based practitioner's perspective, she had to move in quickly and help Jimmy as soon as possible. To see what Mae and Sue did to overcome these problematic contingencies, check out Chapter 11.

The Dumbass Award #1

But, before we go on, let me give a brief shout out to Brian Iwata for making me feel like a dumbass and thereby earning my official Dumbass Award. Note, he's not the dumbass, I am. I'm also a very cool behavior analyst and, therefore, way back when, I realized that most, if not all, problem behavior occurs because it's learned, it's reinforced. In other words, problem behavior is *not* an expression of some deep, mysterious inner illness in the person's mind or soul. And I also realized that it occurred because of the presentation of reinforcers, maybe an obvious tangible reinforcer, like candy or a toy, given to distract the kid and calm him down, or maybe the more subtle nontangible reinforcer, attention, like the love and sympathy we may show the kid because he's so obviously distressed, like Rod's crying in Chapter 2 and Eric's tantruming in Chapter 6. In either case, the reasonable, well-meaning adult has no idea the tangible or loving attention is reinforcing and thereby causing the child to perform that stressful problem behavior. But in any case, I, Dick Malott, was certainly cool for having this insight into problem behavior, an insight shared with most of my behavior-analytic colleagues. But then, Brian blew my cool by pointing out the overlooked obvious, that, of course, problem behavior could also be reinforced by the removal of a negative reinforcer, by the negative reinforcement contingency, like escape from work, as in Jimmy's case. Obvious once Brian pointed this out to us, but never even thought of, at least by most of us, before Brian started his research in this area. And even more to the point, the research of Brian and others has gone on to show that much, if not most, problem behavior is actually reinforced by the previously overlooked negative reinforcement contingency! Thank you, Brian, for getting us out of the positive reinforcement rut.

QUESTIONS

1. *Functional assessment*—define it.
2. What are the three functional assessment strategies?

Example of a Functional Assessment
School Psychology

ATTENTION DEFICIT HYPERACTIVITY DISORDER

Bob Ball stood tall and relaxed. The band blared the Lincoln Junior High fight song. And the crowd chanted, "Sink it, Bob! Sink it, Bob!" They knew he would. He knew he would. And he did: Whoosh—the basketball slipped through the net without touching the rim. Bob, the state's junior high free-throw king had just raised his free-throw percentage from 82 to 84. The ball barely got back in play before the whistle blew and the game was over, 42–41. Lincoln Junior High had won again.

Bob Ball stood tall; Bob Ball walked tall though the Lincoln Junior High hall. But all was not well at Lincoln J. H. All was not well with Bob Ball. It was the day after his big victory, and Bob Ball had just been suspended from the team; his grades were so lousy that he was now ineligible to play. And now Bob Ball would have to repeat the seventh grade.

When all else fails, including Bob Ball, it's time to call in a behavior analyst. Of course, the coach was concerned about Bob Ball, so he called his old football-playing college buddy, Juke, and, eventually, the buck stopped with Mae.

Functional Assessment (F-7)

With the permission of Mr. and Mrs. Ball, Mae did a functional assessment, using the interview strategy first.

Teacher Terry: Bob's work is great—when he does his work. He understands the material. He just can't stay on task long enough to complete his work. He continually disrupts class with his smart-aleck remarks and behavior. When I reprimand him, he insults and threatens me. Then I send him to the principal's office.

Mae thought: Bob isn't learning much in the principal's office.

Teacher Terry: According to our regular school psychologist, Bob has attention deficit hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD). He can't concentrate.

Mae thought: We could solve student problems so much more easily if other school psychologists would stop putting labels on the kids and start doing functional assessments of the problem behaviors.

Mae asked: When does Bob make his smart-aleck remarks and disrupt?

Teacher Terry (after a thoughtful pause): When he has to do a written assignment. Every day in my writing class, I require the students to write in their journal for about 6 minutes and to write a story for about 20. Bob hates writing.

Mae continued her functional assessment, moving on to the observation strategy. She observed Bob Ball and Teacher Terry in the writing class for a week. During that week, Bob started to disrupt the class every time he was told to begin writing. And Teacher Terry sent him to the principal's office.

Mae thought: Looks like this is the contingency:

Before	Behavior	After
Bob has to do the hated writing.	Bob disrupts with word and deed.	Bob doesn't have to do the hated writing.

1. What kind of contingency is this?

a. reinforcement by the presentation of a reinforcer
b. negative reinforcement—reinforcement by the removal of a negative reinforcer

Then Mae talked to Bob: What could we do to help you?

Bob Ball: I need more time to think about what I have to write. I can't stand the pressure.

Later, Teacher Terry said: Yes, Bob is more likely to get down to work and less likely to disrupt when we discuss the topic before he has to start writing.

Intervention (G-2)

There are various procedures Mae might have used to help Bob, such as allowing him to escape the writing tasks if he politely asked to do so (this is known as *differential reinforcement of alternative behavior*; Chapter 11), but then he might never learn to write. Instead, she and Teacher Terry wanted to decrease the aversiveness of the task, thus giving Bob less reason to escape. (As you will see in Chapter 13, that involves changing the motivating operation.) Giving Bob less reason to escape would result in his learning to write better and also would make life more pleasant for everyone, including Bob Ball and Teacher Terry. As Bob had indicated, maybe he needed more time to think about his writing before he started. So, before each journal-writing session, Bob was allowed to brainstorm with a peer for a few minutes.

Mae recorded the percentage of time Bob was on task (e.g., actually writing) during the writing sessions as opposed to being off task (e.g., calling out, gesturing, talking to peers, playing with objects, making funny faces). As you can see in the following graph, the brainstorming worked. Bob Ball was right; he just needed a little more time to think before he wrote. His on-task behavior increased 26.6% when Mae and Teacher Terry allowed the brainstorming (Figure 7.1).

Mae and Teacher Terry tried a different intervention for the story-writing assignments; they allowed Bob (and the rest of the students) to write the stories with a computer rather than by

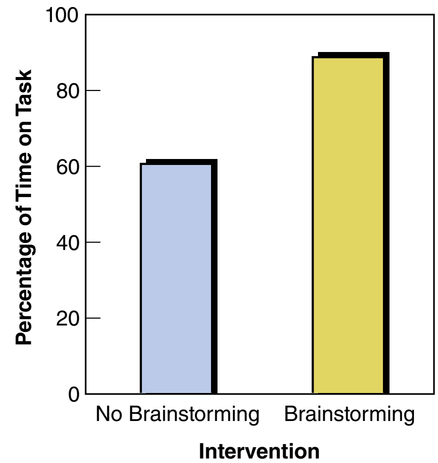


Figure 7.1 Brainstorming Intervention to Increase Bob's On-Task Behavior

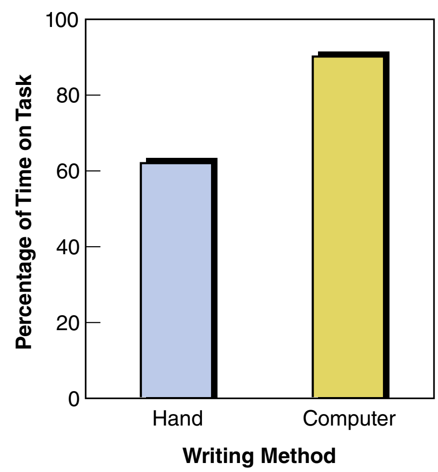


Figure 7.2 Computer Intervention to Increase Bob's On-Task Behavior

hand. And that worked, too. Bob's on-task behavior increased 32% when he could write with the computer (Figure 7.2).

Now it's not clear how writing with the computer changed the effect of the negative reinforcement contingency that reinforced Bob's disruptions. Maybe writing with the computer was less aversive than writing with a pencil, and thus Bob was less likely to escape the task by being disruptive. Or maybe writing with the computer was actually fun, because it was novel and because computers are just fun. And so, even though writing was still aversive, hard work, maybe Bob was less likely to escape that work by disrupting because that would mean he would also lose the opportunity to type on the computer (as you will see in Chapter 9, such a contingent loss is a negative punishment contingency).

Oh, yes, Bob Ball's grades went up enough that the school lifted his suspension, and he was able to lead Lincoln Junior High's seventh-grade basketball team through the season undefeated.

QUESTION

1. Please describe a couple of interventions designed to decrease the aversiveness of the negative reinforcers that were reinforcing a student's escape behavior.

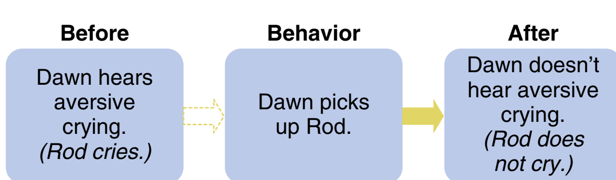
Example of the Sick Social Cycle (Victim's Negative Reinforcement Model) Behavioral Family Counseling

FAMILY LIFE—PART II

Dawn puts Rod in his bed and tiptoes out of the room. But Rod starts crying as soon as she crosses the threshold. So she returns and picks him up in a soothing way. His crying turns to a whimper, and his whimper turns to sleep.

Now what are the behavioral contingencies operating here? In analyzing a behavioral episode involving two people, the first step is to specify whose behavior you're considering and what that behavior is. If you don't, you'll botch it four out of five times. We've looked at Rod's crying, and we've said Dawn's comforting attention may have reinforced it.

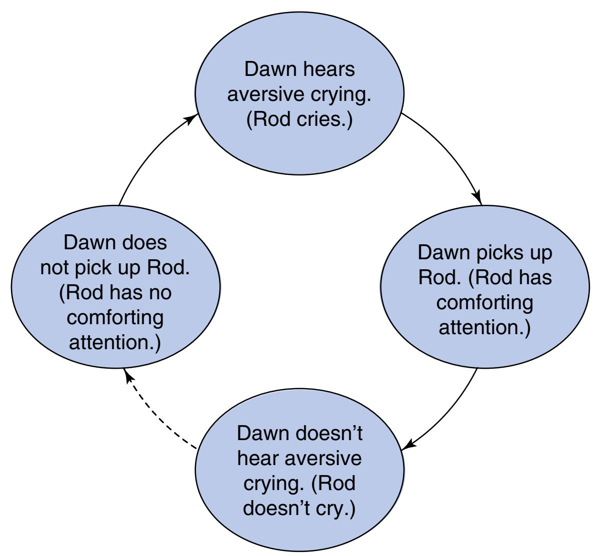
So now let's look at Dawn's behavior—her response of picking up Rod. What reinforced that response? Relief from Rod's crying. Then what kind of reinforcement contingency is this? Hint: Nothing is more aversive than the sound of a crying baby, especially yours. Of course, this is an instance of negative reinforcement—reinforcement by the removal of a negative reinforcer (Rod's crying).



This is all obvious to us as we sit here safely looking at life from behind a one-way mirror. But it's not always so obvious if you're on the other side of the one-way mirror trying to deal with a crying baby, especially yours.*

Dawn's problem is a good example of the **sick social cycle (victim's negative reinforcement model)**. Someone behaves in an aversive way (your baby cries whenever you leave him). You make an escape response (pick up your baby) that causes the person (your baby) to stop acting aversively. Escape from that negative reinforcer negatively reinforces your escape response, so you will be more likely to make the same escape response the next time. But your escape response (picking up your baby) negatively reinforces the aversive behavior (your baby's crying). So the aversive behavior also will be more likely to occur in the future. And the sick social cycle goes around and around.**

We then combine Rod's and Dawn's diagrams to show the interaction between them, the sick social cycle:



* My guess is that crying and sounds of distress are *unconditioned* negative reinforcers. This may often promote the survival of the infant when Ma and Pa make an appropriately nurturing escape response. On the other hand, there are also non-nurturing responses that negatively reinforce (or terminate) the sound of a crying, stressed-out infant.

** I've designated the person creating the inappropriate negative reinforcer *the perpetrator* (Rod) and the person escaping that negative reinforcer *the victim* (Dawn). In truth, of course, they are both victims of the sick social cycle, but later, it helps to distinguish between the two roles. As you read this and the next chapter, maybe you can suggest a better terminology. If so, please e-mail it to me for some pseudo bonus points.

Note that the dashed line means that there's a break in the cycle, often greater than 60 seconds.

We start with Dawn's not picking up Rod. In a sense, that causes Rod to cry (the solid arrow between the two). And in a sense, Rod's crying causes Dawn to pick him up (the next solid arrow). And in a sense, Dawn's picking up Rod causes him to stop crying (the third solid arrow). For the final connection, we've drawn a dashed arrow, indicating that the end of this episode does not cause the beginning event of the next time around the cycle (Dawn's not picking up Rod); furthermore, a fair amount of time may elapse between the end of one episode (Rod's not crying) and the beginning of the next. Nonetheless, it is a sort of cycle in that one episode will influence the next episode by increasing the likelihood that Rod will cry and increasing the likelihood that Dawn will pick him up. Incidentally, these arrows may be a little too metaphysical for your teacher, who may want you to say *followed by*, rather than *causes*, for all four arrows.

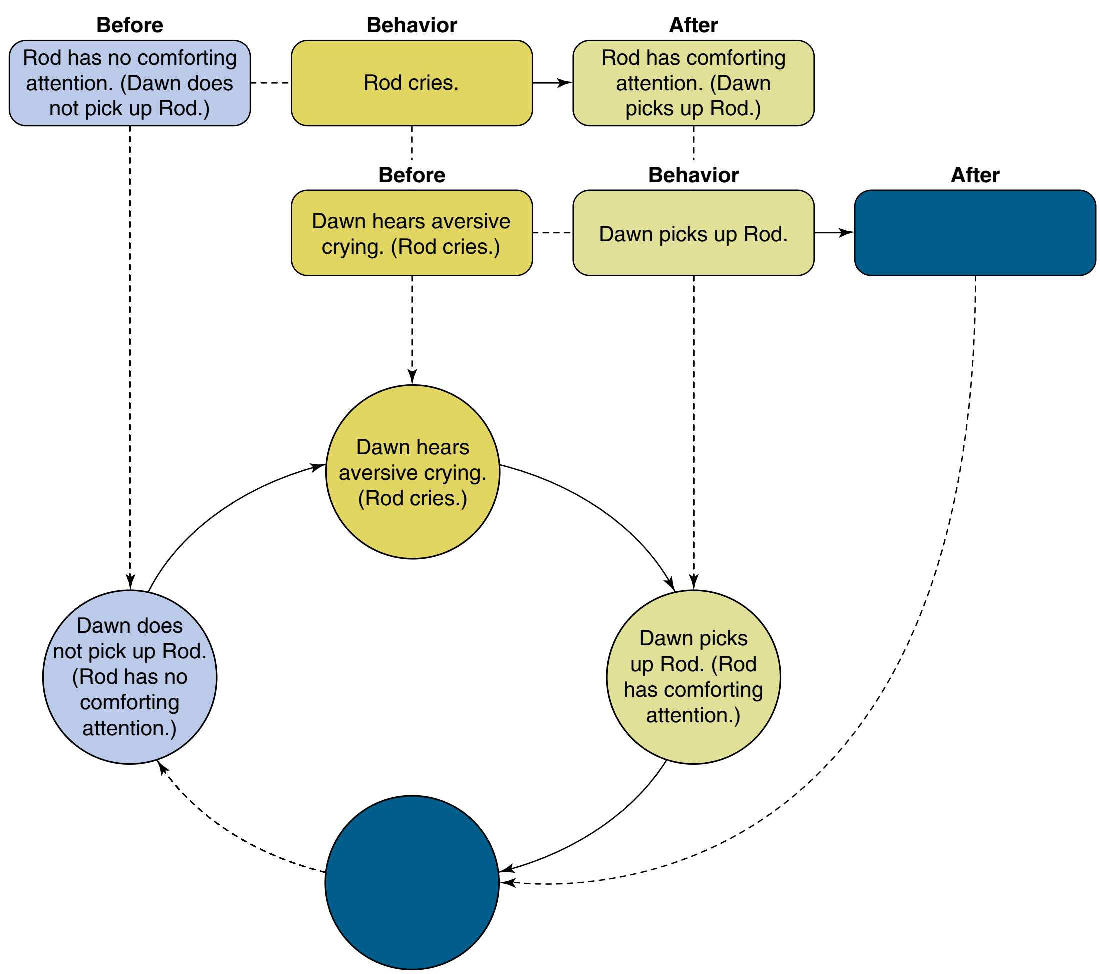
Finally, we unite all three diagrams to show how the two component diagrams make up the sick social cycle (see the following diagram).

The tints and the descending, dashed arrows may help you see how the components in the top two contingency diagrams combine to form the sick social cycle beneath them.

Unfortunately, the sick social cycle is typical of many of our efforts to correct behavioral problems. The parent or teacher (victim) attempts (victim's negatively reinforced behavior) to quiet a child or get the child to start studying. And that attempt produces momentary success. But, in the process, the adult also reinforces the child's (perpetrator's) undesirable (aversive) behavior when he or she attends to that behavior. Picking up the child reinforces crying, and the child's stopping crying reinforces picking it up. And the sick social cycle goes around and around.

Rod and Dawn's Sick Social Cycle (Victim's Negative Reinforcement Model)

The generic diagram for the sick social cycle (victim's negative reinforcement model) and its components is shown in the diagram on page 119.



Look at the first two component contingencies. Note that the first one is for the aversive behavior of the perpetrator. Also note that the before and after conditions for that contingency result from the behavior of the victim. Similarly, note that the second contingency is for the negatively reinforced behavior of the victim. And the before and after conditions for that contingency result from the behavior of the perpetrator. Usually, it will help to diagram those two contingencies that way.

Note that the first contingency is always some sort of reinforcement contingency, either reinforcement by the presentation of a reinforcer or reinforcement by the removal of a negative reinforcer; in other words, there's either a positive or negative reinforcement contingency. But, in either case, the perpetrator's inappropriate behavior is reinforced, again, either positively or negatively.

Note that the second contingency is always a negative reinforcement contingency, in which the victim's inappropriate escape behavior is negatively reinforced.

Also note the names in the parentheses in this diagram of Rod and Dawn's sick social cycle; the name of the other person involved is in the before and after condition, because the other person is the source of the outcome in the after condition. So for Rod's diagram, parenthetical Dawn is in the before and after conditions; and for Dawn's diagram, parenthetical Rod is in the before and after conditions. Still works better to have only the name of the person whose behavior we're analyzing in the behavior box, of course. Same deal for the generic diagram.

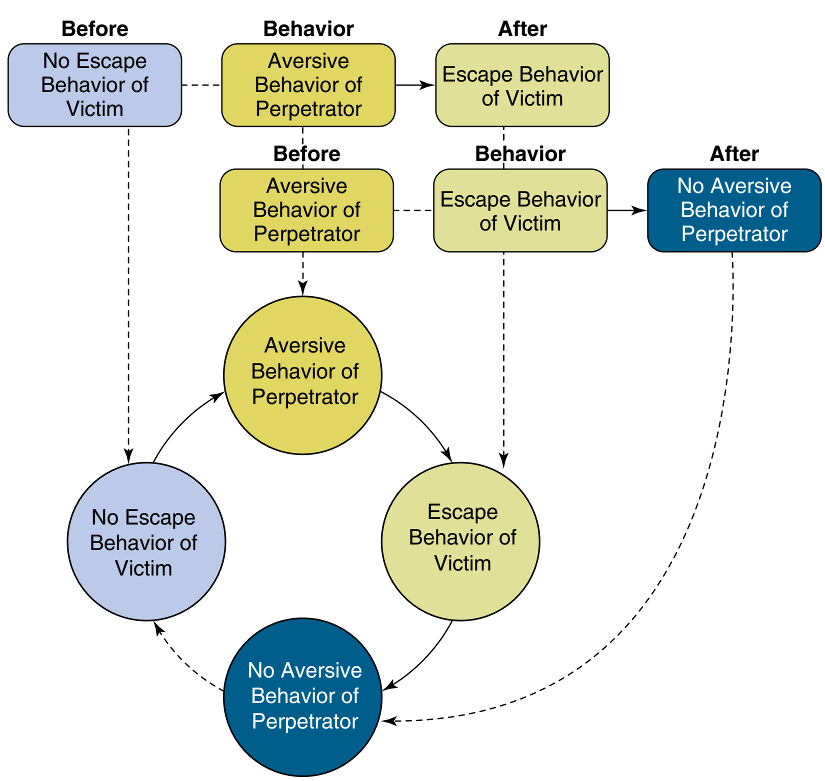
Note that the dead-man test does *not* apply to the before and after conditions of a contingency. So it's OK that the victim is not behaving in the before condition of the first contingency, because that's really a stimulus condition for the perpetrator. And similarly, it's OK if there's no aversive behavior by the perpetrator in the after condition of the second contingency diagram.

The Generic Sick Social Cycle (Victim's Negative Reinforcement Model)

Definition: GENERAL RULE

The sick social cycle (victim's negative reinforcement model)

- In escaping
- the perpetrator's aversive behavior,
- the victim unintentionally reinforces
- that aversive behavior.



Here's our original version of this shortened definition: *Often, aversive behavior occurs because such behavior is reinforced by the attention, approval, or compliance of another person. In turn, the temporary relief from that aversive behavior reinforces the giving of that attention, approval, or compliance by the other person*. But this longer definition was too long to memorize. So read both a couple of times, and the longer definition will help you understand the shorter definition. Then memorize the Twitter version.

Most of the time, most of the victims seem unaware that the ways they reduce aversive behavior often increase the future frequency of that behavior. For example, Spot jumps upon Katie, and Katie throws Spot's rawhide chewy bone to get him off. And Katie's escaping the pathetically aversive sight of Spot's begging at the dinner table is a classic example. As is Dad's giving Junior some candy to stop his crying at the supermarket. I think most often perpetrators are also unaware of the impact of their behavior on the victim. Of course, sometimes the perpetrators may be quite aware of the way their aversive behavior is manipulating their victim, as when Susie Creamcheese says to one of her friends, "Watch me whine until Daddy buys me an ice-cream cone."*

HEALTHY SOCIAL CYCLES

Often healthy social cycles involve two negative reinforcement contingencies. Baby cries when his diaper is wet, and Mom changes the diaper to escape the crying. But it's healthy because both of those behaviors are acceptable. A healthy social cycle might also involve two positive reinforcement contingencies. Your friend asks for a ride to work, and you get a grateful thank you when you provide it. Or it could be negative and positive reinforcement. You hold the door open for the stranger behind you, which gets a thank you, and they say thank you, which escapes the negative reinforcer of being perceived as an ungrateful wretch. And these are all healthy, because they help the world go 'round more smoothly.

QUESTIONS

1. *Sick social cycle*—define it and give an example.
    a. Draw the two contingency diagrams for your example.
    b. Draw the circular diagram of the sick social cycle.

* Thanks to Michelle Seymour for this true story, and thanks to the late Frank Zappa for the name. And you can find out more than you should know about Susie Creamcheese with a little Googling.

2. Now please fill in the diagram for your whole sick social cycle. (The contingency for the perpetrator goes in the first row; the contingency for the victim goes in the second row.)

In the Skinner Box: Experimental Analysis of Behavior

ESCAPE FROM ELECTRIC SHOCK

The next time you look through the window of the Skinner box, you notice that now the floor is a series of parallel, quarter-inch stainless steel rods, spaced half an inch apart. There's no hole for the water cup. But the familiar response lever still protrudes from the wall. The rat is standing with its paws right above the lever. Suddenly it pushes the lever down and then releases it slowly. A little later, the same thing happens again.

What's going on here? Every now and then, a small electric current passes through the grid of steel rods that make up the floor—a negative reinforcer. The electric shock stays on until the rat presses the lever, then it goes off. This is negative reinforcement of the lever press response by the removal of the aversive electric shock.

Before	Behavior	After
Shock on	Press lever	Shock off

After some exposure to this contingency, the rat responds so quickly that it experiences practically no aversive electric shock; still, this is a gruesome procedure—one that reflects more of our everyday life than we might care to admit. This is a negative reinforcement contingency—reinforcement by the removal of a negative reinforcer. It's *reinforcement*, because the frequency of behavior *increases*. It's *negative* because the *removal* of the shock is what increases the frequency of the behavior.

QUESTION

1. Diagram a negative reinforcement contingency in the Skinner box.**

** *Didactic diddling*: The instructor who encounters our simple little contingency diagrams for the first time may find the *before condition* unnecessarily redundant with the *after condition*. And logically, that's a good criticism, but we think it's not a good criticism pedagogically or didactically. Redundancy is the foundation of clear exposition. Students have a hard time understanding the nature of contingencies, understanding that

Experimental Analysis of Behavior

LEARNING WITHOUT AWARENESS OR CLUELESS AT COLUMBIA: THE CASE OF THE TWITCHING THUMB[4] (B-13)

Here's one of my all-time favorite experiments. Dr. Ralph Hefferline and two of his grad students at Columbia University worked with a human response so small that the person making the response was unaware of it. They worked with a tiny thumb twitch.

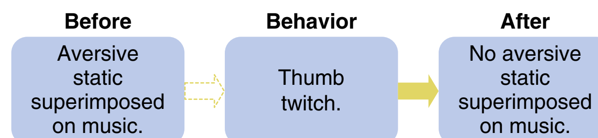
How could they work with a thumb twitch so small that the twitcher was unaware of it? Well, even invisible muscle contractions (e.g., tiny twitches) produce a small but measurable electric voltage (1 to 3 microvolts). So scientists taped electrodes (small metal disks) to the person's left thumb and hand and wired the electrodes to an electronic amplifier that amplified the voltage by 1 million so that they could read the voltage on a meter.

They then taped a few extra (nonfunctional) electrodes and wires here and there on the person, to make the thumb wire less conspicuous. The person sat in a reclining lounge chair, listening to elevator music through earphones. The experimenters worked individually with 12 people, divided into four groups of three people each.

- They told the first group, the completely clueless, that the experiment was about the effects on body tension of noise superimposed on music. The person was just to sit there listening to the music with occasional noise interruptions.
- They told the second group, the semi-clueless, that a specific, small, invisible, but unspecified response would briefly turn off the noise. They also said that when the noise wasn't present, the response would temporarily postpone it.
- They told the third group, the hip, that the effective response was a tiny twitch of the left thumb.
- They told the final group, the techno-hip, about the effects of the tiny twitch, but also they put a meter in front of the twitcher during the first half hour of the negative reinforcement/avoidance phase. This meter was connected to the amplifier and indicated the occurrence of the proper twitches.

During baseline (the first 5 or 10 minutes), the elevator music played with no noise.

During the negative reinforcement/avoidance phase, the aversive noise came on; and when the noise was *on*, each tiny thumb twitch (1 to 3 microvolts) turned it off for 15 seconds—a negative reinforcement contingency.



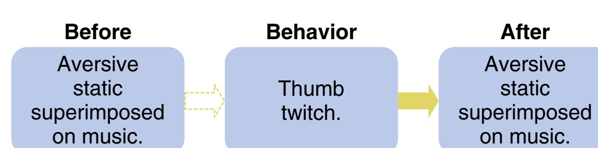
Negative Reinforcement Contingency

And when the noise was *off*, each tiny thumb twitch postponed it for 15 seconds—what we call an avoidance contingency (Chapter 17). So a thumb twitch every 15 seconds would postpone the noise throughout the rest of the negative reinforcement/avoidance phase.

Avoidance Contingency

After 1 hour with the negative reinforcement/avoidance contingency, a 10-minute extinction (Chapter 10) phase started: The noise came on and stayed on, no matter how much that thumb twitched.

Extinction of the Thumb Twitch



Then they returned to baseline—with no noise, just elevator music.

the response produces a change from one condition to another, from the before to the after. They have a hard time seeing the relation between the before and the after condition. And laying it all out in this super-explicit manner greatly helps. In support of our argument, we invite the skeptical instructor to observe the students' initial difficulty in applying these little diagrams to novel examples. And also, we invite the skeptical instructor to do a social validity check with the students at the end of the semester: Ask them if they found the diagrams helpful (by the way, we're talking about grad students, as well as undergrads).

RESULTS

So, who learned the thumb twitch, and who didn't? Especially, what about the first group, the clueless?

The clueless twitchers did well, greatly increasing the frequency of their effective escape/avoidance thumb twitches, even though they were completely unaware of what was going on.

Skeptical? Are you thinking they may have started out clueless, unaware, but then they figured out what was going on and started thumb twitching so they could escape and avoid the noise? Hefferline was skeptical too, so he asked them. All three still believed they'd had no influence on the noise and were shocked to learn they had been in control. Wow!

But we shouldn't be too surprised that human beings can learn without awareness; Rudolph the Rat certainly can. So here's the point: Yes, we can learn without being aware of the contingency or even the response. Outcomes can control our behavior without our awareness.

What about the semi-clueless, those who knew that some small unspecified response would escape and avoid the noise? They did well too, but not in the way you might think. Two gave up searching for the magic response and sank into effective cluelessness. The other guy said he'd figured it out: "I'd act like I was subtly rowing with both hands, wiggle both my ankles, move my jaw to the left, breathe out, and then wait." Yeah, well, whatever.

And the hip, who knew the contingencies and the response? Only one of the three learned the response. The other two kept so busy making large thumb twitches that the small, reinforceable twitches had too little opportunity to occur.

And the techno-hip with their twitchometer? They did best of all. Even during the second half of the negative reinforcement/avoidance phase, when the meter was removed, they continued with the same high frequency of their tiny twitches.

During the extinction phase, when the noise was on continuously, everyone's twitching dropped back to the original, low baseline frequency (extinguished). And during the return to baseline with no noise, the twitching was also at the low baseline frequency; so, fortunately, Hefferline didn't turn the experimental participants out onto the mean streets of NYC with dangerously twitching thumbs.

Now, these last three groups were interesting, but let's not lose sight of the first group and the big deal. THE BIG DEAL IS THAT CONTINGENCIES CAN CONTROL OUR BEHAVIOR, EVEN WHEN WE ARE UNAWARE OF THOSE CONTINGENCIES, THE BEHAVIOR, OR THAT ANY CONTROLLING IS GOING ON, at least when the outcomes follow the response within a fraction of a second or so.

Now, it's a big jump from Hefferline's tiny twitches, but I'll bet most of us are unaware of most of the contingencies controlling most of our behavior and even unaware of much of the behavior being controlled, like our example from Chapter 6: *Sid, did you know you were scratching yourself in a private part of your body, when you were standing in front of your class lecturing? Oh, my gosh, no! Was I really? How embarrassing*.

Sid itches → Sid scratches → Sid itches less.

And he didn't even know. And you didn't even know, until reading this, that you were tapping your foot, or chewing on your pencil, or stroking your hair, or engaging in other behaviors that produce some automatic reinforcement. Or that you are cracking your neck every 5 minutes to get rid of that aversive stiffness. And even though you didn't know of (weren't aware of) those contingencies until now, they have been controlling your behavior since before you could walk and talk.

QUESTION

1. Describe an experiment that demonstrates learning without awareness.
   - What species were the subjects?
   - What was the response?
   - What were the contingencies?
   - What were the differences in the procedures for the four groups?
   - What were the results for the four groups?

Positive and Negative Reinforcers and Reinforcement

Here's a refresher: **Negative reinforcer (aversive stimulus)**: any stimulus whose termination following a response increases the frequency of the response.

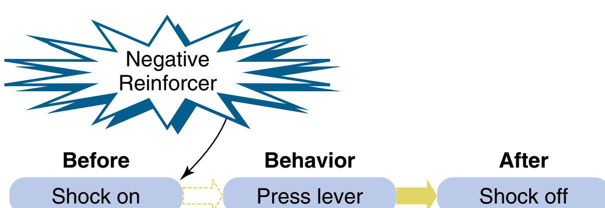
Both for nonhuman animals and for people, stimuli, conditions, and events exist that will function as negative reinforcers. In other words, both animals and people will be more likely to do things that have previously removed those stimuli, events, or conditions—those negative reinforcers. For example, Ed's leg movement seemed to become more likely because each movement immediately stopped the electric shock (Chapter 2).

Warning: *Negative reinforcer* refers to the aversive stimulus (the shock)—not the condition of relief (no shock). This distinction will completely confuse you at least 10 times during your studies of behavior analysis. That's one reason we prefer the unofficial terminology *aversive stimulus*.

But if you're going to deal with other behavior analysts or their writings, you may need to work hard on the use of *negative reinforcer* because it's so difficult to use correctly. To keep it simple, let's take another peek inside the Skinner box. Let's look at the rat in the negative reinforcement experiment. What's the negative reinforcer?

"It's when the shock goes off. It's the absence of shock."

Close; you're only 100% wrong. The negative reinforcer is the shock. We know it doesn't make sense, but look at the definition again and maybe it will: **Negative reinforcer**: a stimulus that increases the future frequency of a response its termination follows. ***Termination*** is the key word here.



You said the absence of shock was the negative reinforcer. Does the termination of the *absence* of shock reinforce the lever press response—the escape response? Put another way, does the presentation of the shock reinforce the lever-press response? Of course not. It's the termination of the shock itself that reinforces the lever press, not the termination of the *absence* of the shock. So, the shock is the negative reinforcer.*

We tend to think of the reinforcer as something good. But it ain't necessarily so—not if *negative* precedes it. The negative reinforcer is the stimulus you escape from, not the stimulus that provides relief. In this context, *negative* means "subtraction" or "removal." So, the negative reinforcer is something you remove.

Still confused? Then remember this: The negative reinforcer is the *aversive stimulus*.

Just as we have *negative reinforcer*, we also have *negative reinforcement*. *Negative reinforcement* is the same as *escape*, or *reinforcement by the removal of an aversive stimulus*. Here, *negative* means *removal*.

QUESTIONS

1. Which of the following is the negative reinforcer in a Skinner box negative reinforcement experiment?
   a. the shock
   b. the food
   c. the termination of the shock
   d. the termination of the food
      Warning: Please be sure you've got this one cold because too many students are blowing it on the quiz, and we find the sight of a poor quiz score a negative reinforcer.
2. Please explain your answer to the previous question by the logic of the definitions and the table.

Pronunciation

Does your instructor love you?

a. yes
b. no

If you answered yes, that means your instructor cares about your education and your well-being, which means your instructor will give you an oral quiz to make sure you can pronounce the following words properly:

- *aversive*, not *a**d**versive*
- *aversive* with the *a* sounding soft like the *a* in ***a**ttention*
- not hard like the *a* in ***a**pe*
- and not super-soft like *a* in ***f**ather*

Also

- *escape* not *e**x**scape*
  And for good measure,
- *e**t**cetera* for *etc.*, not *e**x**cetera*
- *especially*, not *e**x**specially*

* We'll worry about the exceptions some other time. For the moment, give us a break. This concept is hard enough to deal with without the exceptions.

If your instructor really loves you and cares for your well-being, he or she will provide corrective feedback any time you mispronounce one of these words in class. If your instructor makes a condescending smirk while giving this feedback, however, his or her motivation might be questioned.

Notes

1 Based on Goldiamond, I. (1984). Training parent trainers and ethicists in nonlinear analysis of behavior. In R. Dangel & R. Polster (Eds.), *Parent training foundations of research and practice*. New York: Guilford Press.

2 Inspired by Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18,* 111–126. For this edition, we have changed some of the details about Jimmy to help the examples flow from chapter to chapter, but the basic concepts are the same, as well as the principles behind Carr and Durand's intervention.

3 Based on Iwata, B., Pace, G. M., Dorsey, M. F., Zarcone, J. R., Vollmer, T. R., Smith, R. G., . . . Willis, K. D. (1994). The functions of self-injurious behavior: An experimental-epidemiological analysis. *Journal of Applied Behavior Analysis*, *27*, 215–240.

4 This section is based on Hefferline, R. F., Keenan, B., & Harford, R. A. (1958). Escape and avoidance conditioning in human subjects without their observation of the responses. *Science, 130,* 1338–1339. I moved this section from Chapter 15 in *PoB* 5e to Chapter 3 in *PoB* 6e because the concept of learning without awareness is too important to hold off until Chapter 15, even though we don't get to *extinction* until Chapter 10 and *avoidance* until Chapter 17.

PART V

Punishment

CHAPTER 8

Positive Punishment

Behavior Analyst Certification Board 5th Edition Task List Items		
B-6.	Define and provide examples of positive and negative punishment contingencies.	Throughout
B-7.	Define and provide examples of automatic and socially mediated contingencies.	Page 136 and throughout
B-8.	Define and provide examples of unconditioned, conditioned, and generalized reinforcers and punishers.	Throughout
F-6.	Describe the common functions of problem behavior.	Page 129
F-8	Conduct a functional analysis of problem behavior.	Page 129
G-16.	Use positive and negative punishment (e.g., time-out, response cost, overcorrection).	Page 132 and throughout
H-3.	Recommend intervention goals and strategies based on such factors as client preferences, supporting environments, risks, constraints, and social validity.	Pages 140–142

Concept

POSITIVE PUNISHMENT CONTINGENCY (B-6)

In the first chapters, we talked about increasing behavior with the reinforcement contingency. Now we need to look at the dark side of life—decreasing behavior with the positive punishment contingency.

Definition: CONCEPTS

Punisher (aversive stimulus)

- A stimulus
- that decreases the future frequency of a response that
- its **presentation** follows.

Positive punishment contingency (punishment)

- The response-contingent
- presentation of
- a punisher
- resulting in a **decreased** frequency of that response.

We'll concentrate on the definition of the contingency, but of course there is a corresponding principle behind the contingency. ***Positive punishment principle:*** *A response becomes less frequent if a punisher (an aversive stimulus or an increase in an aversive stimulus) has followed it in the past*. (Note that the more immediate the punisher, the more effective the punishment contingency.)

Like the principle of reinforcement, the punishment principle is a fundamental principle of behavior constantly governing our daily lives. And, on second thought, punishment isn't the dark side of life. It's our friend. Punishment protects us from the dark side of life. Suppose you're a middle-aged college professor. And suppose your favorite library is your bathroom. Suppose that for the last 40 years you've attained most of your book learning sitting on a toilet. Now suppose your toilet seat is cracked so that every time you get up from the toilet, the treacherous seat pinches your rear end.

What's the contingency? Only the most cautious or most kinky would question that the pinch is a punisher. But it wasn't until we replaced the seat with a less vicious one that the college professor realized how effectively the pinch-punishment contingency controlled his incautious rising from the seat. Without thinking, he slowly shifted his weight, cautiously raising his rear end off the seat. On seeing how foolish his caution was with the new seat in place, he realized how effectively the friendly punishment contingency had protected his backside from the dark side of life.

Not only do you appreciate the value of aversive stimuli and punishment when you no longer need it, but you also appreciate it when you do need it but don't have it. Because of a damaged nerve, people sometimes lose the sense of pain from part of their body, such as from a finger. So the punishment principle doesn't apply to that finger. That means they have a hard time keeping their finger from getting burned, cut, pinched, or further damaged. This loss of sensation occurs in certain forms of leprosy, where the main damage to the limbs doesn't result from gangrene. Instead, the limbs lack pain reception, so the punishment principle can't protect them.

Remember this:

A punisher is one we tend to minimize contact with.

This is consistent with the punishment principle—a response occurs less frequently if a punisher or an increase in the aversiveness of the punisher has followed it.

If the response that produces that punisher occurs less frequently, we'll minimize contact with the punisher.

Without the punishment principle, we'd constantly trash our bodies. The punishment principle does a good job of preventing us from constantly scalding ourselves in the shower or when we drink a hot liquid, from freezing ourselves in the winter, or even from walking into door frames instead of through them.

QUESTION

1. *Punisher* and *positive punishment contingency*—define them and diagram an everyday example using them.

Example Behavioral Medicine

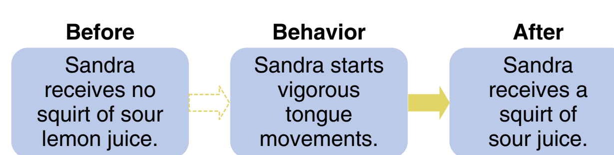
LEMON JUICE AND LIFE-THREATENING REGURGITATION[1]

Sandra was born with a cleft palate (split in the roof of her mouth) and a cleft lip, so for her first few days of life she had to be tube fed. She was from a low-income family and was raised by her aunt. Actually, many different people, including neighborhood children, took care of her. There were indications of neglect.

When Sandra was 6 months old, her aunt had her admitted to the University of Mississippi Hospital. She was severely underweight, weighing less than she had when she was born. She regurgitated (threw up her food) and lay passively without smiling, babbling, grasping, moving, or even crying. Sandra was seriously malnourished and dehydrated and in danger of dying. However, in spite of exhaustive examinations, the university physicians could find no medical cause for her problems.

The behavior analysts who worked with Sandra were Thomas Sajwaj, Julian Libet, and Stewart Agras. They observed that as soon as she had been fed, Sandra "would open her mouth, elevate and fold her tongue, and vigorously thrust her tongue forward and backward." Soon she would be bringing up the milk and causing it to flow out of her mouth. She didn't cry or show sign of pain during this regurgitation.

They started a mild punishment procedure. They squirted some unsweetened lemon juice into Sandra's mouth as soon as she started the vigorous tongue movements.



Sandra decreased her regurgitation by half during the first 20-minute punishment session following her feeding. By the 12th day, she stopped throwing up her milk (Figure 8.1). And what about instances of her vigorous tongue movements that had been part of her regurgitation? From that time on, they dropped out. So the important part of this punishment procedure lasted only 12 days.

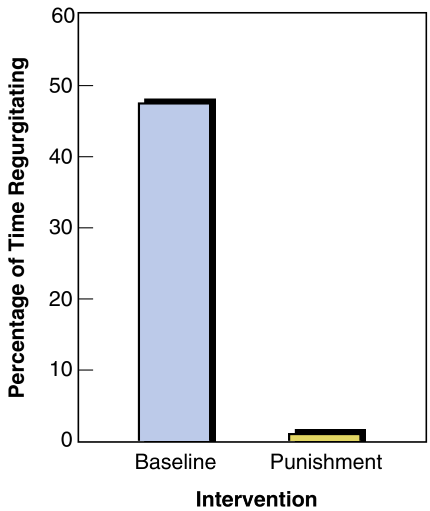


Figure 8.1 Using Lemon-Juice Punishment to Reduce Regurgitation

Further, 2 months after the start of the punishment procedure, Sandra's weight increased from 8 to 12 pounds, and a year later to 24 pounds. Also, Sandra became more attentive and started smiling, babbling, and grasping objects. When she was 19 months old, tests showed that she had almost acquired the behavioral repertoire typical for her age.

QUESTION

1. Describe the use of a punishment contingency to get rid of regurgitation. What was the intervention, and what were the results?

Example Behavioral Medicine

SELF-INJURIOUS BEHAVIOR[2]

Fifteen-year-old Wade had a severe intellectual disability and had no language; but even worse, he constantly hit himself in the head. When not placed in restraints, he would hit himself in the head over 100 times per minute—almost twice a second. He also pinched and picked at his body and screamed almost constantly. Years and years of this self-injury had given Wade the cauliflowered ears of a seasoned boxer, along with permanent facial discoloration and scar tissue buildup.

He'd started his self-injury when he was around 2 years old. By age 15, this was seriously threatening his welfare. The staff at school had started using elbow restraints to prevent the self-injury, but this made it nearly impossible for him to engage in learning tasks. He was also in restraints 100% of the time at home.

You might think the pain of hitting himself in the head would punish his self-injury and cause him to stop. It didn't. Why not? Wade may have acquired this dangerous head hitting over a long period, gradually increasing the force of the blows; and, as he did so, his body had adjusted to the stress. In that way, he drifted into the pathetic state where the severe blows to his head were not aversive enough to punish his head hitting.

In spite of Wade's seeming indifference to the aversiveness of pain, Linscheid and Reichenbach hoped they could get rid of his self-injury by presenting a mild but novel punisher each time he hit his head. In spite of Wade's seeming indifference to punishment, they were betting on their intervention—positive punishment.

To see if their intervention would have a chance at being effective, they first tested it out in a controlled setting. They measured head hitting in 5-minute blocks under different conditions. In each condition, he was sitting in between his mom and one of the researchers, who would prompt him to stop hitting if things got too bad. To get baseline data they put inflatable guards on Wade's hands, which reduced the intensity of each blow to his head, and then they allowed him to hit his head freely for 10 minutes. In those 10 minutes, he hit himself over 20 times per minute on average. Then they put the self-injurious behavior inhibiting system (SIBIS) device on him. This special device has two parts—a sensor on the head can detect any blows to the head; and when it does, it sends a signal to a watch-size device (normally worn around the leg); that device then produces a brief, mild electric shock to the leg.

Each head bang now produced a brief, mild shock. This positive punishment contingency had a dramatic effect. In the first 5-minute session, he hit himself about four times per minute, receiving the mild shock each time. In the next 5 minutes, he didn't hit himself *at all*. No restraints and no hitting. Unheard of for Wade. By the end of 40 sessions of testing with the hand guards still on, they were confident that the SIBIS could effectively reduce Wade's self-injury. Hitting was low when SIBIS was active and jumped back up when they turned it off.

Then it was time to test the punishment contingency, without the hand guards, and not in the therapy setting but in the real world—Wade's school. Linscheid and Reichenbach measured both the rates of self-injury and rates of positive behavior, like laughing, smiling, and making contact with other people. They took a few days of baseline data at school with no SIBIS, but his self-injury was still too high, over twice per minute on average (about 800 hits per 6-hour school day). And then they had Wade use SIBIS just in the afternoon for 3 days; his afternoon self-injury immediately fell to zero, though the rate in the morning was still too high.

But enough experimental analysis with baseline testing; it was time for Wade to start wearing SIBIS during the entire school day, every school day. And when he did, his hitting remained at zero; what a success! And not only were his head hitting and the other self-injurious behavior essentially eliminated, they also saw a clear increase in his smiling, laughing, and approaching other people. The administration of the occasional mild electrical shock did not make Wade a more miserable person; instead, it helped him become a happier one. When you're hitting your head almost every second, you don't have time to do much else. But with the positive punishment contingency in place to reduce the head hitting, Wade now had the opportunity to engage in other, appropriate, reinforced behaviors.

After seeing the success of the intervention at school, Linscheid and Reichenbach also implemented the system at Wade's home, where it was also very successful. They kept their eye on Wade for 5 years. Impressive dedication. In those 5 years, the most head hits and shocks in 1 month was 120 (about four hits a day), but most months were typically well below that level. In fact, whole weeks with no self-injury became common. His parents and teachers reported that Wade was now much happier; he could live free of physical restraint and participate more normally in many activities, including Christmas shopping.

Functional Analysis (F-6) (F-8)

You might have trouble understanding self-injury because it persists though the consequences are painful and harmful to the person. You might ask, what reinforces and maintains such harmful behavior? Different contingencies could maintain self-injurious behavior, depending on the behavioral history of each person. Sometimes it's escape from an aversive event, or negative reinforcement; other times it is an automatic, positive reinforcement contingency (e.g., sensory stimulation). And sometimes the well-intentioned contingent presentation of attention reinforces and maintains self-injury.

Linscheid and Reichenbach did a functional analysis in an attempt to determine what maintained Wade's self-injurious behavior—what function it served. And, as we saw with Jimmy in Chapter 7, a functional analysis is a type of functional assessment to find the relevant reinforcement contingency. Linscheid and Reichenbach intentionally provided the different consequences for the head hitting to see if the rate would change based on those different reinforcement contingencies. If they had found a positive or negative reinforcement contingency that caused the hitting, they could have eliminated the contingency so Wade's hitting would extinguish. But Wade seemed to hit his head regardless of the consequences they provided or withheld, suggesting that, contrary to what you might expect, the physical, sensory stimulation immediately following each hit was reinforcing those hits, stimulation the researchers couldn't eliminate. So, in cases like this, punishment is sometimes the only viable option to reduce life-threatening, self-injurious behavior.

QUESTION

1. Describe the use of a positive punishment contingency to prevent self-injurious behavior. What was the intervention and what were the results?

Compare and Contrast

NEGATIVE REINFORCEMENT VS. POSITIVE PUNISHMENT (PART I)

Negative Reinforcement—Escape

You've just completed a major pig-out. Your jeans are so tight around your stomach you can't slip your palm between your waistband and you! As you've done so often in the past when in this condition, you secretly slip the button open and lower the zipper to half-mast. The tight jeans were an aversive condition you removed by making the escape response of lowering your zipper. We suspect that the tight jeans were aversive, and removal of that aversive condition negatively reinforced the escape response because you often unzip after a pig-out.

Positive Punishment

You've just completed a major pig-out. Now it's time to dress for your evening on the town. You put on your favorite jeans—right, the tight ones. But because of the pig-out, you have to take a deep breath before you can zip them all the way. After you've repeated this fiasco on a few evenings, you find yourself preferring your old jeans, for some strange reason. We suspect that the tight jeans were an aversive condition, and we suspect that their tightness punished your putting them on after a big meal.

People often have a hard time distinguishing between negative reinforcement (reinforcement by the removal of negative reinforcer) and positive punishment (punishment by the presentation of a punisher). One problem is that both contingencies involve aversive stimuli. And it may seem like aversive stimuli always decrease performance, but it ain't necessarily so.

Remember that reinforcement makes a response occur more frequently, but punishment makes a response occur less frequently. Both negative reinforcement and positive punishment involve aversive stimuli. But for reinforcement to occur, we should remove that aversive stimulus; for punishment to occur, we should present the aversive stimulus.

This contingency table summarizes the relations between the contingencies. We've added one new one since the last chapter. First select "present" from the top row and "aversive stimulus" from the left column. Then select the corresponding cell from the middle area—"positive punishment" (rate decreases). This means that *if you present a punisher, you have a positive punishment contingency that will decrease the rate of the response*. (By the way, the bold cell in the table may give you some hint about the contingency we'll cover in the next chapter.)

Contingency Table (preliminary #2.1)

Stimulus	Present	Remove
Positive Reinforcer	Positive Reinforcement ⇑	(See Chapter 9) ⇓
Negative Reinforcer	Positive Punishment ⇓	Negative Reinforcement ⇑

Remember: This ⇑ means the response becomes more frequent. So you don't need to be a rocket scientist to know what this ⇓ means.

And here's the other form of essentially this same table. If you present a stimulus (a cell from the row across the top) and the response frequency decreases (a cell from the column along the left), then you've got a positive punishment contingency (corresponding inside cell), which you can call *punishment by stimulus addition* or, more commonly, *positive punishment* (S^{P+}).

Contingency Table (preliminary #2.2)

Stimulus	Present Stimulus	Remove Stimulus
Response Frequency Increases ⇑	**Positive Reinforcement Contingency** Reinforcement by stimulus addition (S^{R+})	**Negative Reinforcement Contingency (Escape)** Reinforcement by stimulus subtraction (S^{R-})
Response Frequency Decreases ⇓	**Positive Punishment Contingency** Punishment by stimulus addition (S^{P+})	**Negative Punishment Contingency (Penalty) (See Chapter 9)**

QUESTION

1. Use an example or two to compare and contrast the following (also construct and use a contingency table in the comparing and contrasting):
    - Negative reinforcement
    - Positive punishment

Remember: To do well on the quizzes you must be able to construct or fill in any tables you see. And memorizing without understanding won't get it, because the tables may be arranged differently on the quizzes.

Example Behavioral Clinical Psychology

UNDESIRABLE HABITUAL BEHAVIOR[3]

Sid had been staring at his writing on the computer screen for the last 10 minutes. Sitting, staring, his left elbow propped on the left arm of his swivel desk chair, his head propped by his left hand, his index finger rubbing his left eye. Pause . . . more rubbing, and rubbing, and rubbing.

Dawn stood in the doorway, observing but unobserved. "Sid, quit it!" Sid jumped and immediately pulled his finger from his eye and started typing. Then he stopped and laughed.

"You caught me that time. I know rubbing my eye bugs you. What's wrong with a little eye rub now and then?"

"Sid, it looks awful, and you do it all the time." She sat in the chair next to his desk, put her right elbow on the desk, and began chewing her right thumbnail. "Besides it can't be that good for your eye. Your eyelid even looks red from all the rubbing."

"Come on, Dawn, that's from lack of sleep."

"Just your left eyelid?"

"Can't I rub my eye in the privacy of my study?"

"No. And you can't rub your eye when you lecture to your classes; they think it's a joke. And last year when you presented your paper at the Association for Behavior Analysis conference, you stood there rubbing your eye the whole time. It was embarrassing."

"I'll stop rubbing my eye when you stop biting your nails."

Now it was Dawn's turn to jump. She jerked her hand from her mouth and sat on it. Then she grinned, gave her head a nod that set her long, blond hair billowing, and rolled her eyes to the heavens in a show of innocence. This had been an effective escape response, always getting her off the hook with her father, but it was less effective with her husband.

"You're a PhD, not a 5-year-old girl, and I'm not going to let you cutesy your way out of it this time. You're right, I don't want to rub my eye. But you don't want to bite your nails either. So here's what I'll do."

Dawn stopped grinning.

"You come up with a behavioral intervention to help you grow those long, sensuous, elegant, sophisticated nails you want. And if you can apply that same intervention to my minor eye rubbing, I'll let you, 'cause I'll admit I don't want to be the weirdo of the Psych Department."

The next evening at dinner, Dawn said, "I spent the afternoon in the library, and I found an article by Miltenberger and Fuqua. It looks to me like they have the intervention. But before I tell you what it is, let's collect baseline data for 6 days. Always carry this 3 × 5 card with you, and each time you rub your eye, record it. I'll do the same with my nail biting. This way we can get a better idea of how effective the Miltenberger-Fuqua intervention is."

"Dawn, I'll carry that card every place but in the shower."

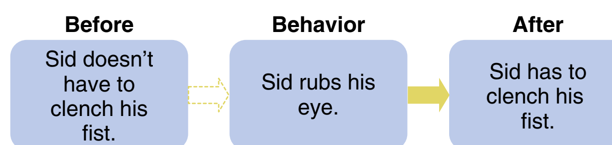
At dinner 6 days later, Dawn asked, "Are you ready to hear about Miltenberger and Fuqua's procedure?" But she didn't wait for Sid to reply before she started to explain. "I interpret it as a simple self-punishment procedure."

"What kind of apparatus will we need? Will we have to strap electric shock electrodes to my arm?"

"All you'll need is your eye-rubbing hand. Each time you catch yourself rubbing your eye, you should stop immediately, make a fist, and hold it for three minutes."

"How do you figure that's a punishment procedure?" Sid asked.

"Having to clench your fist is effortful, it's a nuisance, and sometimes it might be embarrassing. I don't mean it's a strong punisher, but it seems aversive enough," she answered. "So each eye-rubbing response will immediately produce a mild punisher, the clenched fist. That should be a positive punishment procedure."



"Are you going to use the same positive punishment contingency for your nail biting?"

"You bet," Dawn replied.

"Then let's go for it."

What were the results? Sid kept intervention data on himself for 24 more days—and the data looked good. Sid's eye rubbing dropped from a mean of 11 per day to 3. Dawn collected baseline data for 4 days more than Sid and intervention data for 20 days. And Dawn's nail biting dropped from 20 episodes per day to 5 (Figure 8.2).

Sid became a little less the departmental weirdo with the raw red eye. And Dawn became a little more the sophisticated lady with the long red nails. Each was happier to be seen in public with the other.

QUESTION

1. Diagram the positive punishment contingency for getting rid of an habitual behavior.

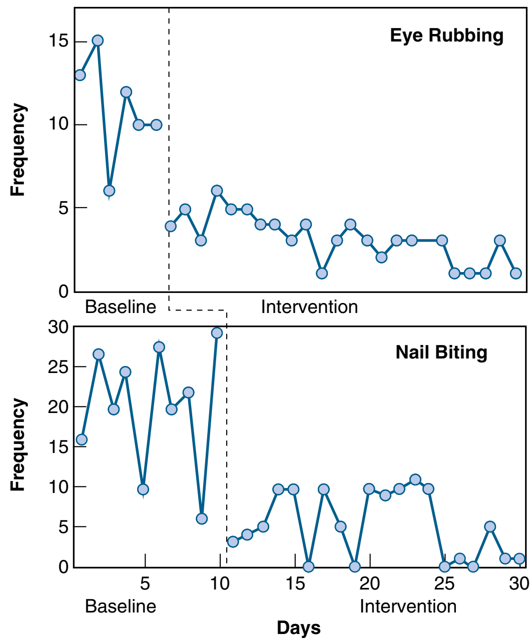


Figure 8.2 Multiple-Baseline Design Across Subjects and Behaviors

Example People With Mental Disabilities

CONTINGENT EXERCISE[4]

Ten-year-old Peter choked, kicked, hit, pulled, and pushed people an average of 63 times each 6-hour school day. His teachers had transferred him from a classroom for mentally disabled children to a classroom for severely disturbed children.

The behavior analysts who worked with Peter in the new classroom were Stephen Luce, Joseph Delquadri, and Vance Hall. They knew that much of the work in punishing aggressive behavior has used painful stimuli, like electric shock. But they also knew that such procedures are usually not allowed in public school classrooms. So they sought and found a more acceptable punisher—exercise. Each time Peter assaulted someone, the teacher required him to alternately stand and sit on the floor 10 times. They selected this task because Peter did it frequently during playtime; and yet if the task were required and repeated 10 times, it might be effortful enough to be a punisher. Another reason for selecting this effortful task was that the physical education consultants said it would benefit Peter's physical fitness.

Peter's physical attacks decreased from an average of 63 per day, during baseline, to 10, during the first day of the positive punishment procedure. After 10 days of the punishment procedure, the attacks dropped to an average of 2.3 per day (Figure 8.3).

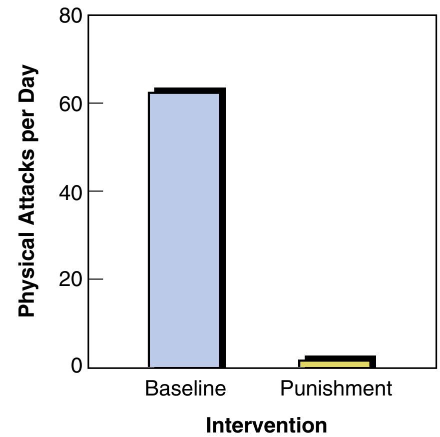


Figure 8.3 Punishing Aggression With Contingent Physical Exercise

The punishment procedure was so successful in suppressing Peter's aggression that it actually provided little opportunity for physical exercise.

QUESTION

1. Describe the use of a positive punishment contingency to reduce aggression. What was the intervention and what were the results?

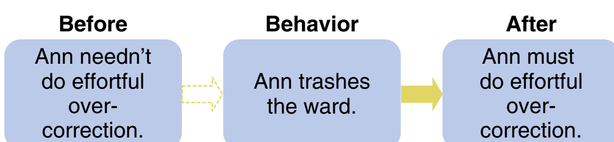
Example People With Mental Disabilities

OVERCORRECTION[5] (G-16)

Ann was a violent, 50-year-old woman with an IQ score of 16 (100 is average). She had been in an institution since she was 4 years old and had been violent since she was 13. About 13 times per day she completely trashed her ward, overturning beds, chairs, tables, anything not nailed down. Life for residents in a ward for people classified as mentally disabled is never that great, but it was unbearable with Ann there.

Drs. Richard Foxx and Nathan Azrin used a procedure they had developed and made famous—*overcorrection*. With this procedure, the person overcorrects for any problem behavior. Not only do people who overcorrect make things right with the environments or the people they've disturbed, but they also make things better than they were before their disruptions. And they must do so with effort and with no opportunity to rest until they've overcorrected. (When needed, the staff use physical guidance to ensure that the client overcorrects.)

In Ann's case, she had to set the furniture right and then, for example, remake the bed neatly and fluff the pillows on all the other beds in her ward. Or she had to clean the entire dining room after sweeping and mopping the food from the table she had upset. After that she had to apologize to the people whose furniture she had overturned. Because she couldn't talk, she nodded "yes" when the attendant asked if she were sorry.



Some students have said they didn't understand why having to straighten and clean the ward was a punisher. Because it's hard work! People who don't understand that hard work is a punisher probably have never done any.

The results? After 37 years of violence, the overcorrection procedure reduced Ann's rate of overturning furniture from 13 times per day during baseline to less than four per day, within 1 week. After 11 weeks of overcorrection, Ann stopped her violence completely! (Figure 8.4). Imagine that: Foxx and Azrin got rid of a 37-year problem in 11 weeks—no small trick!

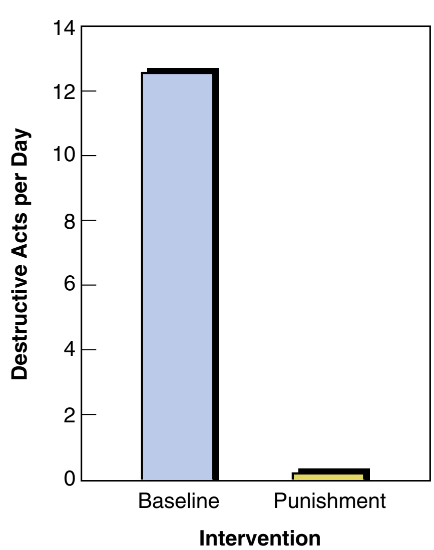


Figure 8.4 Punishing Destructive Acts With Overcorrection

This type of overcorrection is called *restitutional overcorrection*, in which the person repairs his or her damage and then some. Overcorrection sometimes has additional features. It may involve *positive practice*, where the person practices doing correctly what he or she had done wrong. Overcorrection always involves corrective behavior relevant to the inappropriate behavior and may have an educational value. But many behavior analysts think the main virtue of overcorrection is that it involves an effective punishment procedure that is usually socially acceptable (it has social validity). In other words, overcorrection is really a positive punishment procedure, but it is one that often can be used when other punishment procedures are prohibited. It is also true that contingent exercise may be more acceptable than traditional forms of punishment.

Definition: CONCEPT

Overcorrection

- A contingency
- on inappropriate behavior
- requiring the person
- to engage in an effortful response
- that more than corrects
- the effects of the inappropriate behavior.

QUESTION

1. *Overcorrection*—define it and give an example.

General Comments About Positive Punishment

Research on positive punishment suggests several conclusions:

1. In many cases, you don't need to use electric shock. You can get rid of inappropriate behavior using more acceptable punishers, such as

- the effort of squeezing your fist
- the effort of correcting for past disruptions
- the effort of physical exercise
- the brief touching of an ice cube to the face
- a squirt of sour lemon juice
- a reprimand

2. These punishers can quickly and effectively suppress behavior, even if the person has been doing that behavior for many years—for example, in the cases of
    - habitual behavior
    - self-injurious behavior
    - aggressing
    - teeth grinding
    - goofing off
    - self-stimulating
3. Even with excellent reinforcement programs, added punishment contingencies sometimes greatly improve performance, as in the cases of
    - a remedial grade-school classroom
    - vocational training for people classified as profoundly mentally disabled
4. Because the positive punishment contingency often suppresses behavior so quickly and effectively, the client usually makes little contact with the punisher, as in the cases of
    - lemon-juice punishment of regurgitation
    - shock punishment of self-injurious behavior
    - shock punishment for harmful sneezing
    - contingent exercise for aggression against people
    - overcorrection for aggression against property

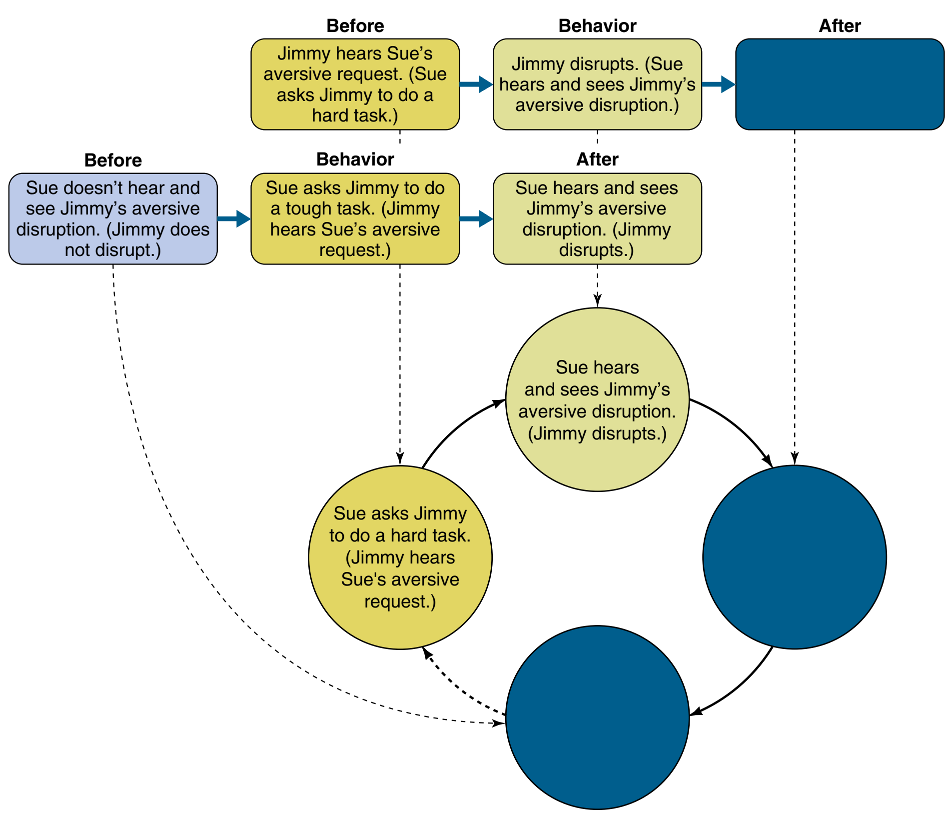
Example of the Sick Social Cycle (Victim's Punishment Model) Behavioral Special Education

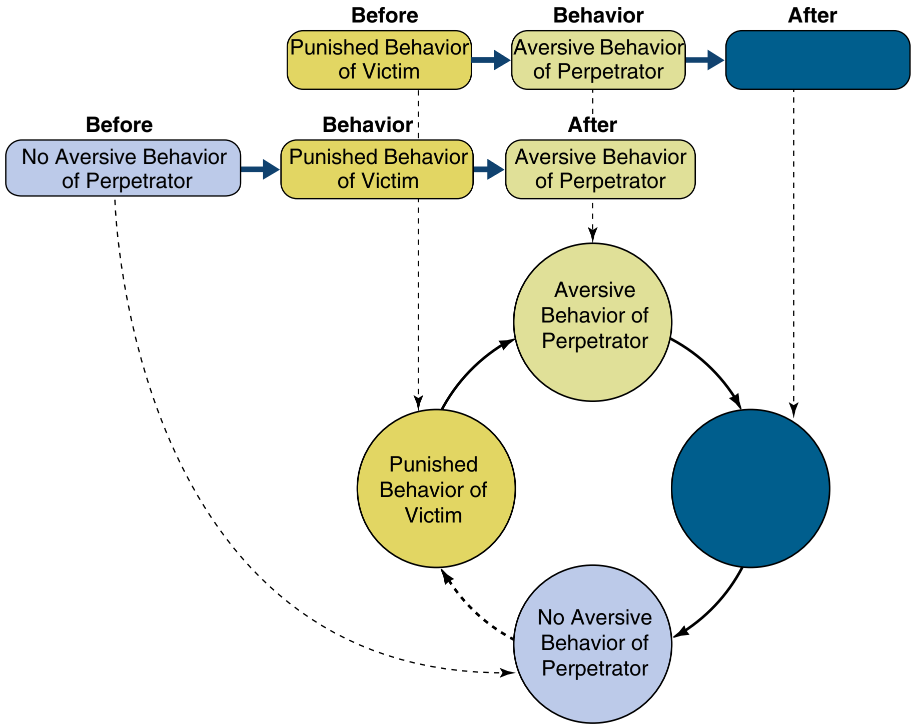
JIMMY, THE CHILD WITH AUTISM[6]—PART III

Remember, from Chapter 7, how Jimmy escaped difficult tasks by disrupting the training sessions. Well, he and Sue had a type of sick social cycle going, because she negatively reinforced his aversive, violent disruptions by allowing him to escape the difficult training task. On the other hand, Jimmy's violent disruptions punished Sue's insisting that he stay on task. In this case, Sue (the victim) stopped her appropriate insistence that Jimmy stay on task because her insistence was being punished by Jimmy's (the perpetrator's) aversive disruptions (see the following diagram).

Jimmy and Sue's Sick Social Cycle (Victim's Punishment Model)

We start with Sue's asking Jimmy to do a tough task. In a sense, that causes Jimmy to disrupt (the solid arrow between the two). And in a sense, Jimmy's disruption causes Sue to





stop insisting that he do the tough task (the next solid arrow). And in a sense, Sue's no longer insisting causes Jimmy to stop disrupting (the third solid arrow). For the final connection, we've continued with our dashed-arrow tradition; the dashed part of the arrow indicates that it might be better here just to say that, sometime later, Jimmy's not disrupting is *followed by* Sue's asking him to do a tough task; and they start rolling through the sick social cycle once again. But these arrows are becoming metaphysical, and you or your teacher may prefer you to say *followed by* for all four arrows.

We should not read more into Jimmy's violent disruptions than is there. He is simply making a response that has been reinforced in the past. We should not say that he is trying to escape, or trying to control Sue, or trying to communicate his needs, or on a power trip. He is not necessarily even aware of what he's doing and most likely not aware of the contingencies controlling what he's doing. And the same might be said of Sue; she might not have realized that she was letting Jimmy off the hook when he disrupted, let alone that her failure to hang in was reinforcing his disruptions. Such lack of awareness is almost certainly the case for many classroom teachers, even special ed teachers.

In Chapter 7, we saw an example of the sick social cycle based on a negative reinforcement contingency for the victim; Dawn's inappropriately timed behavior was reinforced by escape from Rod's crying. In the case of Jimmy and Sue, we have a different type of sick social cycle, one based on positive punishment of the victim's appropriate behavior. The preceding diagram is a generic diagram of this sort of social interaction.

Note that the first contingency is always a negative reinforcement contingency, whereby inappropriate behavior is reinforced by escape from an aversive condition.

Note that the second contingency is always a positive punishment contingency, whereby appropriate behavior is punished by the presentation of an aversive condition.

Definition: GENERAL RULE

The sick social cycle (victim's punishment model)

- The perpetrator's aversive behavior punishes
- the victim's appropriate behavior,
- and the victim's stopping the appropriate behavior
- unintentionally reinforces that aversive behavior.

Remember that the dead-man test does *not* apply to the before and after conditions of a contingency diagram. So it's OK that the victim is not behaving in the after condition of the first condition, because that's really a stimulus condition for the perpetrator. And similarly, it's OK if there's no aversive behavior by the perpetrator in the before condition of the second contingency diagram.

QUESTIONS

1. *Sick social cycle (victim's punishment model)*—define it and give an example
   - Draw the two contingency diagrams for your example.
   - Draw the circular diagram of the sick social cycle.
2. Now please fill in the diagram for your entire sick social cycle. (The contingency for the perpetrator goes in the top row, and the contingency for the victim goes in the second row.)
   - Make sure the first contingency is a negative reinforcement contingency, where the inappropriate behavior of the perpetrator is reinforced by escape from an aversive condition (a negative reinforcer).
   - Make sure the second contingency is a positive punishment contingency where the appropriate behavior of the victim is punished.

Why Presumed Punishment Contingences Don't Always Punish

JIMMY, THE CHILD WITH AUTISM[7]—PART IV (B-7)

In Chapter 6, we read about Jimmy's excessive self-stimulation (hand flapping). As a first step, Kate recorded descriptive data for a few days, noting when he stimmed and what happened as a result of his stimming. She was searching for the cause of his stimming, what function his stimming served—what the reinforcer was. She found that even when he was alone, Jimmy flapped his hands as much as when he was with people or being required to work on difficult learning tasks. So this functional assessment suggested that he stimmed because stimming automatically produced reinforcers (proprioceptive stimuli, e.g., the feeling of flapping your hands). We all stim a little, doing little behaviors that automatically produce reinforcers, behaviors such as toe tapping, whistling or humming, thumb twiddling, and hair stroking. Perhaps many children with autism differ from those of us who stim more covertly only in that these children are less sensitive to social disapproval of such stimming.

Let's look at Jimmy's typically developing peer, Mike. Like any little boy or girl, Mike also does many automatically reinforced behaviors. For instance, he likes to sing to himself. Sometimes they're songs he's heard before, sometimes they're just nonsense tunes he's made up on the spot. He might sing while playing with his toy trains, or maybe in the bathtub—all self-stimulation that produces its own reinforcers. No one is giving him extra attention when he sings as he plays, and he's not escaping any negative reinforcer by singing.

But Mike doesn't sing loudly to himself when he's in public with Mom and Dad because whenever he does, like at a restaurant, Mom and Dad give him the universal "angry parent" look—a frown, a shake of the head, their fingers at their lips. They do this not only because the singing annoys them so much (which it does) but because they don't want everyone in the restaurant to start giving *them* angry looks for having the loud kid. And the result? Mike clams up pretty quickly. Of course he'll still sing out when he's alone or at home, but he's pretty good about holding back in public with Mom and Dad (see Chapter 14 for why this is).

This positive punishment contingency controlled Mike's stimming pretty well. But why hasn't this almost automatic parental disapproval punished Jimmy's stimming? Jack and Amy Lewis could sit there and give him dirty looks each time he stimmed. But their dirty looks would have little to no effect. In other words, dirty looks are not a punisher for Jimmy and will not punish his stimming. Remember, to have a real positive punishment contingency, the stimulus presented in the after condition must truly be a punisher. This might be the corollary to the check your presumed reinforcer rule. The check your presumed punisher rule is certainly just as important if you intend to implement a positive punishment contingency. In Chapter 12, we'll discuss why social disapproval from Mom and Dad is effective for some children and not for others.

QUESTION

1. Please give one example where parental disapproval works and one where it doesn't work as *positive punishment*.

In the Skinner Box
Experimental Analysis of Behavior

PUNISHMENT OF THE LEVER PRESS

This time, when you peep through the window of the Skinner box, you see the water dipper is there again, but the notorious metal rods that make up the floor are still there, too. And of course it wouldn't be a Skinner box without a device with which the animal can respond. For the rat, it's usually the lever, as it is again this time.

On this occasion, the rat acts weird. It keeps approaching the lever and then backing away. It raises its paws above the lever and then pulls quickly away. It touches the lever, ever so leery, and then jerks away.

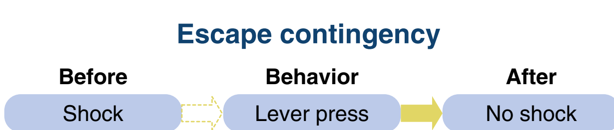
Finally, the rat presses the lever all the way down and jerks slightly; the water dipper raises, and the rat's on that dipper in a flash, licking it clean. Then, slowly, the rat approaches the lever again, as leery as before.

What's going on here? Of course, you only have to look at the title of this chapter to tell. Positive punishment, the presentation of a punisher (a brief and mild electric shock) punishes the lever-press response. The rat is in a bind—the same bind you and I are often in: The same response produces both a reward (the drop of water) and a punisher (the shock). Just like the spoonful of hot soup can produce a good taste *and* a burned mouth. And just like the rat approaches the lever, we approach the hot soup, ever so leery.

Once again, how does this positive punishment contingency compare with the negative reinforcement contingency?

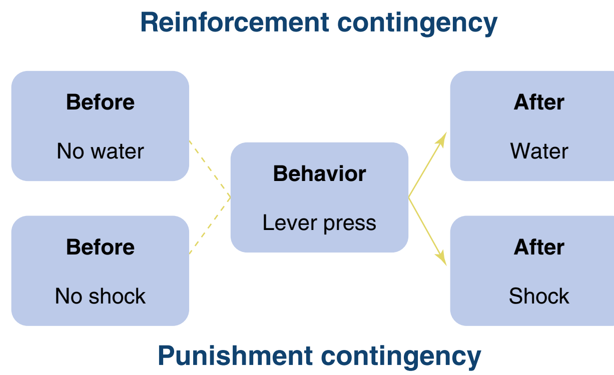
For negative reinforcement, the removal of the shock reinforces the lever press. It's *reinforcement*, because the frequency of behavior *increases*. It's *negative* because the *removal* of the shock is what increases the frequency of the behavior.

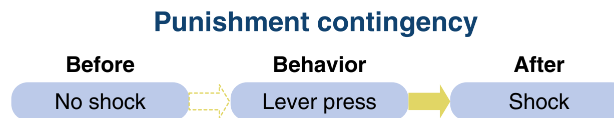
Negative Reinforcement Contingency



For positive punishment, the presentation of the shock punishes the lever press. It's *punishment*, because the frequency of behavior *decreases*. It's *positive* because the *presentation*, not the removal, of the shock is what decreases the frequency of the behavior.

Positive Punishment Contingency





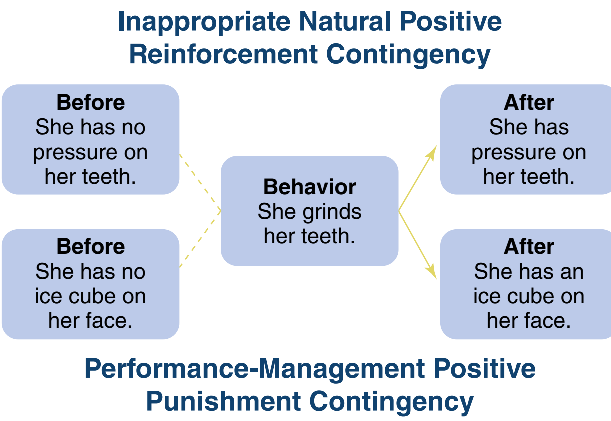
Here's an important point:

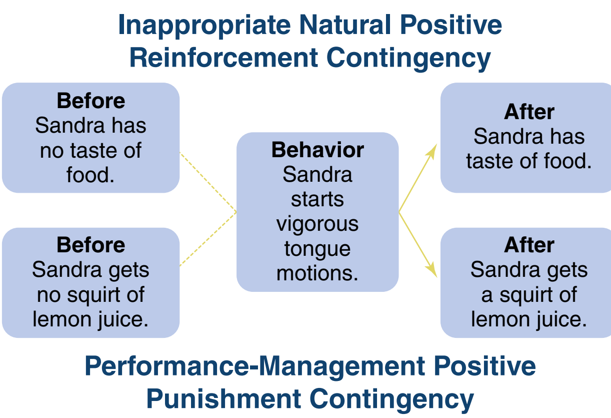
Whenever you have a punishment contingency, there must also be a reinforcement contingency.

Why is that true? Suppose you wanted to demonstrate punishment of the lever press in the Skinner box. You'd need the rat to press the lever before you could punish that response. But how would you get the lever-press response? You'd have to reinforce it—for example, with water.

In other words, for punishment to occur, you need behavior; and for behavior to occur reliably, it must be reinforced. Now it's easy to miss this important point if you just look at the case studies we've presented. In most of those cases, we knew the strange behaviors occurred at high rates. We didn't ask why they occurred. But if they occurred, you can be sure they were producing reinforcers. In these cases, we don't know what the reinforcers were. But we assume there must have been reinforcers.

What do you think reinforced Velma and Gerri's grinding their teeth, Sandra's regurgitating, David's self-stimulating, Sid's rubbing his eye, Dawn's biting her nails, Peter's aggressing, and Ann's trashing the ward? Whew, what a list! Now, most of these studies were done before the common use of functional analysis—an analysis of the contingencies responsible for behavioral problems (nowadays, functional analyses would normally have been done before intervention to see if it would be possible to decrease the behavior without using a punishment procedure). But in these examples, we don't really know what the relevant reinforcement contingencies were that maintained the undesirable behaviors. But here are a couple wild guesses, just to show you what the contingency diagrams look like:





Sandra's vigorous tongue motions caused her to throw up her food, which in turn produced the taste of the food. And, strange as it seems, research suggests that the taste of regurgitated food may sometimes be a reinforcer.

We call these various reinforcement contingencies *inappropriate* when they exert more control over behavior than they should.

In any case, whenever you use a punishment contingency, you should keep your eye on the reinforcement contingency as well. One of the values of the Skinner box is that it highlights the need for a reinforcement contingency. And concern for the reinforcement contingency's maintaining the undesirable behavior is even more important now that the use of punishment has decreased considerably in popularity. In many instances, we are almost forced to do a functional analysis in order to find the undesirable reinforcement contingency. Then we can counteract that undesirable contingency in one way or another—for example, by extinction of inappropriate behavior combined with differential reinforcement of alternative behavior (see Chapter 11).

QUESTION

1. Discuss the notion that whenever you have a punishment contingency, there must also be a reinforcement contingency.

In the Skinner Box
Experimental Analysis of Behavior

BASIC RESEARCH[8]

With Wade's self-injury, we saw how the process of reinforcement and punishment might work in opposite directions. We guessed that Wade's head hitting might have initially occurred because attention reinforced it, or because it allowed him to escape from certain conditions, or because it provided some reinforcing stimulation. We also guessed that the severe physical stress from his head hitting was no longer very aversive for him. Perhaps his head hitting had gradually increased in intensity, causing it to lose its aversiveness.

This may seem like wild speculation, so we need to test the notion with an experiment in the lab. The first question is: Are there circumstances under which a small reinforcer will maintain a response, in spite of an intense physical stressor contingent on each response? If yes, then the second question is, why? What are those circumstances? Research lab-based answers to these two questions will help us understand Wade's case.

Dr. Nathan Azrin used pigeons rather than human beings in a relevant study at Anna State Hospital. Past experiments have shown that most results of this sort of animal research are as true for human beings as they are for other animals.

If we had walked into Nate Azrin's lab then, we might have seen a pigeon inside a Skinner box pecking a small disk that served as a response key (instead of a rat pressing a lever).

Immediately after each key peck, the pigeon flutters its wings, lurches violently, and almost falls down. Looking closer, we notice a pair of wires connected to the pigeon. Through these wires the bird receives a brief but intense shock each time it pecks the key. The power of the shock is why the pigeon almost falls down. Yet the bird keeps pecking the key and getting the shocks. Why? Wade kept hitting his head, in spite of the physical stress. In the same way, the bird keeps pecking the key, in spite of the electric shock.

In fact, why does the pigeon peck the key in the first place? As we keep looking at this peculiarly persistent pigeon, we notice that some key pecks cause a feeder full of grain to come up to a trough in the wall of the Skinner box. Of course, the bird is quick to start eating the food for the few seconds the feeder remains in the trough. Put another way, reinforcement by the food maintains the key-peck response. Just as Wade's head hitting could have produced the potential reinforcer of attention, the pigeon's key pecking produces the occasional reinforcer of grain.

So the answer to our first experimental question is this: Yes, sometimes an animal, and we assume a human being, will tolerate much physical stress contingent on each response, though that response produces only a small reinforcer and even though that small reinforcer occurs only occasionally.

Then what about our second question: Why? What are the circumstances? The answer: We will tolerate much physical stress when the intensity of the physical stress increases gradually.

As we *imagined*, day by day, Wade gradually increased the intensity of his head hitting; we *know*, day by day, Nate Azrin gradually increased the intensity of the electric shock.

Other work had shown that if Nate had started out with a high-intensity shock, the bird would have greatly decreased its rate of pecking and might have stopped altogether. So Nate Azrin's careful laboratory work supports our speculations about the processes underlying this bizarre behavior from the everyday human world.

QUESTION

1. Compare and contrast Wade's case with Azrin's Skinner box experiment.

CONFESSIONS OF AN AVERSIVE-CONTROL ADVOCATE

I'm on the board of directors of the Judge Rotenberg Center (JRC), perhaps the most controversial behavior-analytic residential program in the world. JRC is so controversial because it sometimes uses brief electric shocks in a positive punishment contingency to decrease or eliminate extremely dangerous behavior. JRC invited me to be on the board because I consider the judicious use of aversive control, including punishment with brief electric shock, not only to be appropriate but often necessary for the well-being of all involved, perhaps a minority view.

Here's a case study indicating the horrible conditions that can sometimes be improved with an electric-shock punishment contingency:

Samantha

June 1, 2010

We would like to tell you about our daughter, Samantha, and how the Judge Rotenberg School saved her life.

We first discovered Samantha was different when she was about 2 years old. She would not relate well to others, had very little speech, and would stare at her hands or small objects for hours at a time. She also tantrumed and cried often. So we enrolled her in a program of early behavioral intervention; and over the next 10 years, she attended four schools for autistic children. In addition to her schooling, numerous therapists and teachers came to our house to work with her after hours. All these schools worked closely with her in small groups and one-on-one, using positive reinforcement. She was also under the care of a psychiatrist and received various psychotropic medications.

Despite all this caring professional help, over the years, Samantha became more and more violent, attacking other children, her teachers, and us. She would bite, scratch, kick, hit, pinch, and head-butt. And also, she became more self-abusive. She would hit herself or throw herself on the floor and against hard objects. And she always had marks, and bruises from this self-abuse.

In addition, we were prisoners in our own home, as we could not take her anywhere, due to her behaviors; this had an impact on our other children as well. The final straw came when she hit herself in her head with such force that she detached both retinas of her eyes and was virtually blind. This has subsequently required 6 eye surgeries to repair, and her vision is still far from normal. The school where she was at the time, told us they could not handle her, and asked that we find another school. This is when we learned about the JRC and their use of the electric skin-shock punishment contingency.

Within several weeks of their use of this punishment procedure, a miracle happened; our daughter stopped hitting herself, and stopped her violent behavior. She appeared much happier, and she could be weaned off all of her psychotropic medications.

In June 2006, aversive treatment became a big issue in New York State. A law was passed prohibiting the use of the shock punishment contingency for mild behaviors that often lead to dangerously aggressive behaviors. So JRC had to remove the shock punishment contingency, which led to a period of deterioration where Samantha became more aggressive and angrier. Some of her old behaviors returned. An injunction to this law was obtained several months later, and the shock contingency was again able to be used. As a result, Samantha improved and was happier, no longer aggressing towards herself or others.

Recently, she had another challenge. Due to a congenital condition, she had to undergo complex orthopedic surgery on both legs to correct a balance problem and to prevent future arthritis. JRC staff accompanied her to all her appointments at the Boston Children's Hospital. She remained in the hospital for 6 days after her surgery, with JRC staff members in her room 24 hours a day. In her postoperative period, the staff was with her in her residence at all times and met her every need. She was nonweight bearing for 6 weeks post op, and the staff helped her and transported her to school and to all her postoperative doctor's appointments. Remarkably, through all her pain and frustration of not being able to walk, she remained calm, and pleasant.

Sometimes, we feel that JRC is the most misunderstood place in the world. Our daughter has now been at JRC for over 5 years, and we have seen nothing but love and affection for her on the part of the entire staff. They appear to have the same love for all the students at the school.

The shock procedure is used only after the failure of positive reinforcement programs, and only after the approval of a judge. It is given carefully, and under strict protocols. Everything done at this school and in the residences is video monitored.

The bottom line is that this program helped, and continues to help our daughter where all other programs had failed. Our daughter is a different person than 5 years ago. She is happy, able to concentrate and learn, and fun to be with. And she is on no psychotropic medications. JRC takes only the most difficult kids who have failed at other programs, and make successes of a large number of them. Many of these children have life-threatening behaviors, before arriving at JRC. Everything there is done out of love, not cruelty. We believe our daughter would be dead, or in an institution heavily sedated if it were not for this wonderful school, and caring staff. Many other parents feel the same.[9]

Sincerely,
Dr. Mitchell & Mrs. Marcia Shear
New York

QUESTION

1. Discuss a case study where positive punishment with electric shock eliminated serious self-injury.

Ethics

SHOULD YOU USE ELECTRIC SHOCK IN A POSITIVE PUNISHMENT CONTINGENCY?[10] (H-3)

Sid's Seminar

Tom: I hate this positive punishment contingency, especially with electric shock. Shock is awful just to read about, let alone to experience. There's no way I'd ever use electric shock in a punishment procedure.

Sue: I feel the same way, especially with children who have it forced on them. But then I ask myself if their lives were better after the punishment procedure. And in the cases we read about, I have to answer yes.

Tom: Were they enough better to justify the electric shock?

Sid: Good question. We must always ask whether the benefit was worth the cost.

Sue: Let's look at the cases: For Wade, the cost was a low frequency of brief, mild shocks. The benefits were that he stopped injuring his head and he no longer had to be restrained at all times. That also meant he might have a better chance of acquiring some normal behavior. As for Samantha, the cost was once again the occasional mild shock. And the benefits were that her violent and self-abusive behavior stopped. She didn't have to take powerful psychotropic medications. And she became a happier person with a much higher quality of life.

Joe: In both cases, the physical stress of the positive punishment procedures seems a lot less than the physical stress of the horrible conditions the children suffered. I think the benefits much more than justify the costs.

Eve: In spite of Mr. Field's point contingencies, I haven't talked much in this seminar. But I've got to say something now. The lives of those two children seemed so horrible, in so many of those cases, and especially in the cases of Wade and Samantha, I can't even imagine it. I sure wouldn't volunteer to give those electric shocks. I don't even like to watch a physician stick a needle in someone. But I'd force myself to overcome my squeamishness to help those poor kids live a better life.

Tom: Maybe so, but is that what it takes? Aren't there other ways of helping those kids?

Sid: That's a good point, too. We should always make sure we're using the least aversive and the least drastic, the least restrictive, and the least intrusive intervention.

Sue: In working with other children, behavior analysts sometimes find that attention is reinforcing some undesirable behavior. And they then use contingent attention to positively reinforce a more acceptable alternative behavior. If they'd found that Wade's head-hitting was a result of attention, they might have used attention to reinforce an alternative to that destructive behavior.

Sid: Differential reinforcement of alternative behavior is an excellent idea (and we will learn about it in Chapter 11).

Joe: Maybe. But maybe not always. Suppose they had wasted several weeks messing around with differential reinforcement of alternative behavior and perhaps some other less drastic procedures. And suppose they finally found one that worked. If I were Wade's father, I'd say this to the professionals: "Why in the heck did you subject my kid to several extra, needless weeks of head hitting, while you wasted time searching for some wimp procedure? Why didn't you use a few brief, mild shocks right away, so he could stop destroying himself? My kid has a right to the most effective and quickest intervention you've got."

Sid: You're saying not only should we (1) weigh the costs of the punishment procedure and the benefits of getting rid of the inappropriate behavior, but we also should (2) weigh the costs of searching for a less drastic procedure. We should consider both factors when doing a cost-benefit analysis of punishment.

Joe: Yes, and I'll say this, too: I think the physical stress these positive punishment interventions cause is much less than the physical stress physicians often cause with their treatments involving drugs, injections, and surgery. Yet most people don't get bent out of shape about that.

Max: I read an article by Dr. Brian Iwata where he describes other work similar to that done with Wade using the SIBIS, the Self-Injurious Behavior Inhibiting System, that automatically shocks self-injurious behavior. Here's what he has to say about the need for punishment contingencies: "Our treatment program on self-injury had an overall staff-to-client ratio of about 5:1 (five staff for each client), with BAs, MAs, and PhDs outnumbering clients by better than 2:1. Despite all this expertise, our reinforcement-based approaches to treatment were not always successful. We clearly needed to have available a treatment option based on aversive stimulation." He then adds that his reading of the literature suggests that electric stimulation is often the best way to go, for the client's sake.

Sid: Regarding that, let me read a message from Dr. Peter Holmes that I downloaded years ago from the Behavioral Bulletin Board: "A court case in Flint, MI, may have broad implications for the 'use-of-aversives' controversy. Yesterday it was reported that a U.S. district court awarded a grandmother $42,500 in damages because a school system had refused to permit her granddaughter to wear a SIBIS device in her special ed classroom. (The granddaughter has blinded herself from self-hitting.)"

Eve: That poor child. That's so sad.

Joe: It sure is sad, but I'm happy to hear that the courts are beginning to rule that people have a right to effective behavioral interventions, even if they go against a simplistic set of values of some school policy makers.

Tom: Maybe, but one problem with punishment is that the punishers may end up being role models. And the clients themselves may imitate that use of punishment. And another problem is that caregivers can easily abuse the use of punishment.

Sid: Yes. Children, clients in centers for the mentally disabled and clients in psychiatric hospitals are easy to abuse because they often don't have much power to defend themselves.

Max: That's why many states now have laws designed to protect the rights of defenseless clients in the use of punishment. And most institutions have guidelines for punishment, for example:

- The person's behavior must be dangerous to himself or herself or to others.
- The person probably will benefit from the intervention.
- Solid data suggest that less drastic or less intrusive interventions will not work.
- Generally, use reinforcement to establish appropriate behavior, with any uses of punishment to get rid of inappropriate behavior.
- A well-trained, professional behavior analyst must design and supervise the procedure.
- A clients' rights committee must approve the procedure, and informed consent must be obtained.

Sid: So we use punishment as a last resort and with guidelines to protect the client. And, in fact it's almost impossible to get the use of electric shock approved by review boards.

Max: Let me just add that, in later chapters of this book, the authors describe procedures that may sometimes be good alternatives to punishment.

QUESTIONS

1. What are two factors you should consider in doing a cost-benefit analysis of using punishment?
2. What are six considerations you should include in guidelines for punishment?

CONFUSION BETWEEN PUNISHMENT AND AGGRESSION

In our view, we should not be allowed to use punishment as a performance management or training technique without considerable supervision and accountability for our actions. Here's the problem: Suppose, for example, our child or a child with autism or an adult with an intellectual disability acts inappropriately. Suppose they spit at us. That will be aversive for us. So what do we do? We "implement a punishment contingency." We slap the offender. Why? Because that was a well-thought-out behavioral intervention? No, because when we're aversively stimulated (like when we're spit at), it's reinforcing to strike back, to aggress. And whether we're a parent, a teacher, or a direct care staff member in a training center for intellectually disabled clients, we will tend to hit first and ask questions later. We will tend to go for the aggression reinforcer of striking our tormentor and *then* try to justify our actions in terms of a punishment procedure designed for the best interests of the person whom we're supposed to be helping, the child or client. So it's good that we're restrained in our use of punishment; it's good that we have to have special training and special approval before we even squirt a kid with a little mist in the face. (Some students have misread this to mean that punishment doesn't work, but the point of this whole chapter is that carefully used punishment works very well. The following summarizes the point of this paragraph.)

Don't use punishment in wrath. Don't confuse the behavioral use of punishment with divine retribution. Forget the eye-for-an-eye notion. Divine retribution is God's job; your job is to make that punishment as short as possible; all you want to do is modify behavior, not make people atone for their sins.

QUESTION

1. Please compare and contrast aggression and the careful use of positive punishment.

Compare and Contrast

NEGATIVE REINFORCEMENT VS. POSITIVE PUNISHMENT (PART II)

In Chapter 7, we warned you that the concept *negative reinforcer* confused most students. We said you could escape the confusion by substituting *aversive stimulus* for *negative reinforcer*, at least until the proper use of *negative reinforcer* becomes a strong part of your repertoire. We also said *negative reinforcement* means the same thing as *escape*, which means the same thing as *reinforcement by the removal of a negative reinforcer*.

Now for the big problem: discriminating between negative reinforcement and positive punishment. *Negative reinforcement* is the contingent *removal* of a negative reinforcer. It *increases* the rate of behavior. *Positive punishment* is the contingent *presentation* of a punisher. It *decreases* the rate of behavior.

Fighting the Confusion

Positive Reinforcement	Negative Reinforcement	Positive Punishment
Presentation of a reinforcer	Removal of an aversive stimulus	Presentation of an aversive stimulus
Increases response rate	Increases response rate	Decreases response rate

Think you've got it? Let's see. Suppose you burn your mouth with a spoonful of hot soup. Then, with no hesitation, you gulp down a glass of cold water.

Let's analyze that one. You have two responses here. First, let's look at the response of putting the spoonful of hot soup in your mouth. The outcome? The soup burns your mouth (probably a punisher). What's the contingency? *Negative reinforcement?* Not even close. Remember, just because it's bad doesn't mean it's *negative*, at least not as behavior analysts use the term. For behavior analysts, *negative* means *removal* and *positive* means *presentation*. So, instead, we've got *positive punishment—by the presentation of a punisher*.

Positive Punishment

Before	Behavior	After
You have a cool mouth.	You eat hot soup.	You have a burning mouth.

The second response is gulping down the water. But what's the negative reinforcer? The water? Sorry. The negative reinforcer is the burning mouth (the aversive stimulus)! And what kind of a reinforcer is it? A negative reinforcer. It's negative because it would reinforce by its removal. And the contingency? *Negative reinforcement—reinforcement by the removal of a negative reinforcer*.

Negative Reinforcement (Escape)

Before	Behavior	After
You have a burning mouth.	You drink cold water.	You have a cool mouth.

Remember: Don't confuse *negative reinforcement* with *positive punishment*. In everyday English, negative and punishment mean something unpleasant. But negative reinforcement and positive punishment differ, though both involve aversive stimuli. In the negative reinforcement contingency, the response removes or reduces the aversive stimulus; but in the positive punishment contingency, the aversive stimulus follows the response. Also, negative reinforcement increases the frequency of the response, but positive punishment decreases the frequency. Here is another example:

You get a splinter while grabbing a stick of wood. The pain in your finger (aversive stimulus) probably will decrease the frequency with which you repeat such a careless act in the future: positive punishment by the presentation of a punisher.

Positive Punishment

Before	Behavior	After
You have no splinter in your finger.	You grab a stick of wood.	You have a splinter in your finger.

You pull out the splinter. The reduction in pain (aversive stimulus) probably will increase the frequency that you pull out splinters in the future: negative reinforcement or reinforcement by the removal of a negative reinforcer.

QUESTION

1. Again, compare and contrast negative reinforcement and positive punishment. Use an example and a contingency table in doing so.

Controversy

THE MYTH OF THE INEFFECTIVENESS OF PUNISHMENT

Even among behavior analysts, there is a common, and I think erroneous, notion that punishment isn't effective. The argument is that you must continue to use the punishment contingency in order to keep the punished behavior suppressed; otherwise, it will recover. Yes, but that's true of reinforced behavior also; if you don't continue to use the reinforcement contingency, the reinforced behavior stops, it will extinguish. And contrary to this myth, I've been impressed that the effects of punishment often persist much longer when the punishment contingencies are terminated than do the effects of reinforcement when the reinforcement contingencies are terminated. For example, how many times did you have to touch a hot stove before you stopped making that mistake? Probably not too many. And that controls your behavior to this day. Another interesting example is the invisible fence used to keep dogs in the yard. A wire is buried around the perimeter of the yard, and you put a special collar on your dog. If your dog gets close to the magic invisible perimeter, the collar makes a tone. And if he stays too close or keeps going, he gets a quick little shock—not enough to do any damage, but certainly aversive. And Spot quickly learns; in fact, it might only take a few shocks before he stays in the yard very reliably. He might get a little jolt once in a while, but even if we turned the fence off, it would take some time before the effect of the punishment contingency disappeared. Our data on this are only anecdotal, but we would love to hear about your success or failure with this system. (Please post on DickMalott.com.)

QUESTION

1. Please discuss the myth of the ineffectiveness of punishment.

Notes

1 Based on Sajwaj, T., Libet, J., & Agras, S. (1974). Lemon juice therapy: The control of life-threatening rumination in a six-month-old infant. *Journal of Applied Behavior Analysis*, *7*, 557–563.

2 Based on Linscheid, T., & Reichenbach, H. (2002). Multiple factors in the long-term effectiveness of contingent electric shock treatment for self-injurious behavior: A case example. *Research in Developmental Disabilities, 23,* 161–177.

3 Based on Miltenberger, R. G., & Fuqua, R. W. (1985). A comparison of contingent vs. noncontingent competing response practice in the treatment of nervous habits. *Journal of Behavior Therapy and Experimental Psychiatry, 16,* 195–200.
4 Based on Luce, S. C., Delquadri, J., & Hall, R. V. (1980). Contingent exercise: A mild but powerful procedure for suppressing inappropriate verbal behavior and aggressive behavior. *Journal of Applied Behavior Analysis, 13,* 583–594.
5 Foxx, R. M., & Azrin, N. H. (1972). Restitution: A method of eliminating aggressive-disruptive behavior in retarded and brain-damaged patients. *Behavior Research & Therapy, 10,* 15–27.
6 Based on Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18,* 111–126.
7 Inspired by Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18,* 111-126. Reminder: For this edition, we have changed some of the details about Jimmy to help the examples flow from chapter to chapter, but the basic concepts are the same, as well as the principles behind Carr and Durand's intervention.
8 Based on Azrin, N. H. (1959). Punishment and recovery during fixed-ratio performance. *Journal of the Experimental Analysis of Behavior, 2,* 301–305.
9 For more info on the Judge Rotenberg Center, you can check out http://en.wikipedia.org/wiki/Judge_Rotenberg_Center and http://www.judgerc.org/ as well as controversy all over the Internet.
10 Based on Goldiamond, I. (1984). Training parent trainers and ethicists in nonlinear analysis of behavior. In R. Dangel & R. Polster (Eds.), *Parent training foundations of research and practice* (pp. 504–546). New York: Guilford Press; Griffith, R. G. (1983). The administrative issues: An ethical and legal perspective. In S. Axelrod & J. Apshe (Eds.), *The effects of punishment on human behavior* (pp. 317–338). New York: Academic Press; Iwata, B. A. (1988). The development and adoption of controversial default technologies. *The Behavior Analyst, 11,* 149–157; McGee, J. J. (1987). Ethical issues of aversive techniques: A response to Thompson, Gardner, & Baumeister. In J. A. Stark, F. J. Menolascino, M. H. Albarelli, & V. C. Gray (Eds.), *Mental retardation and mental health: Classification, diagnosis, treatment, services* (pp. 218–228). New York: Springer-Verlag; Martin, G., & Pear, J. (1988). *Behavior modification: What it is and how to do it* (pp. 195–197). Englewood Cliffs, NJ: Prentice Hall; Thompson, T., Gardner, W. I., & Baumeister, A. A. (1987). Ethical issues in interventions for persons with retardation, autism and related developmental disorders. In J. A. Stark, F. J. Menolascino, M. H. Albarelli, & V. C. Gray (Eds.), *Mental retardation and mental health: Classification, diagnosis, treatment, services* (pp. 213–217). New York: Springer-Verlag; Van Houten, R., Axelrod, S., Bailey, J. S., Favell, J. E., Foxx, R. M., Iwata, B. A., & Lovaas, O. I. (1988). The right to effective behavioral treatment. *The Behavior Analyst, 11,* 111–114; We've cited many references here because this is an important and controversial issue. In addition, some references present views that directly oppose ours, but they are views with which the serious behavior analyst should be familiar.

CHAPTER 9

Negative Punishment

Behavior Analyst Certification Board 5th Edition Task List Items		
B-6.	Define and provide examples of positive and negative punishment contingencies.	Throughout
D-5.	Use single-subject experimental designs (e.g., reversal, multiple baseline, multielement, changing criterion).	Pages 163–165
E-3.	Assessing behavior.	Page 165
G-16.	Use positive and negative punishment (e.g., time-out, response cost, overcorrection).	Throughout

Example Developmental Disabilities

USING NEGATIVE PUNISHMENT TO DECREASE SELF-INJURING[1]

Jamal was in trouble from the beginning of his life. His parents put him in a hospital shortly after his birth. During the next 4 years, he got individual and group psychotherapy and dozens of drug treatments to reduce his hyperactivity, screaming, and self-injuring. Nothing worked.

His self-injuring started at age 4. By the time he was 9, he was doing serious damage to himself. Besides slapping his face, he often banged his head against the floors and walls, punched his face and head with his fist, hit his shoulder with his chin, and kicked himself. Also, his self-injury had partially detached the retinas of both of his eyes.

Jamal was all but blind when he was transferred to the Murdock Center in North Carolina where Dr. Tate and Dr. Baroff worked with him. Jamal was 9 then, and aside from the scars on his face, he was a good-looking boy. He didn't speak, though he often uttered a few words—high-pitched, whining words, mostly gibberish.

But Jamal did respond to people. He would always try to touch those who approached him, wrapping his arms about them, climbing into their laps, or clinging to them. Then he would be more tranquil. But when he was alone and free, he would cry, scream, hit himself, and bang his head. There seemed no choice but to keep him tied in bed for the rest of his life. When they untied Jamal, he hit himself several times per minute. He would destroy himself, if he were alone with his arms and legs untied.

Typically, Jamal would lie, tied to his bed, except for his morning baths and daily walks. During these walks, two assistants walked beside him, each holding one of his hands. But even with this physical contact, Jamal continued hitting his chin on his shoulder. During five daily 20-minute baseline sessions, when the assistants did not intervene, Jamal banged his chin on his shoulder at the rate of 396 times per hour! After they had measured the size of the problem, the behavior analysts decided it was time to intervene. But how?

Remember that Jamal quickly grabbed on to any nearby human being. This suggests that such contact was a strong positive reinforcer for Jamal. Why? Perhaps because he was almost blind, and other people had to serve as his eyes. Also, contact with people looking out for his welfare produced food, candy, comforting words, and warmth.

Tate and Baroff reasoned that the contingent loss of this potential reinforcer might punish Jamal's self-abuse. So during the daily walks, whenever Jamal banged his chin on his shoulder, the two assistants immediately let go of his hands until he'd stopped banging for 3 seconds—a **negative**

punishment contingency involving the loss of the reinforcer of human contact.

Before	Behavior	After
Jamal has physical contact.	Jamal bangs his chin on his shoulder.	Jamal loses physical contact.

The results? By the second walk, Jamal's self-injury had dropped from a rate of 396 to six per hour—a fast and effective intervention (Figure 9.1)! Jamal still had many problems (which Tate and Baroff worked on with other behavior-analytic techniques), but at least he could now go for walks with a minimum of self-injury. A major achievement in his barren life.

By the way, during baseline, Jamal whined, cried, walked hesitantly, and ignored his environment. But as soon as he stopped banging his chin, he also stopped whining and crying and started walking without hesitation, attending to his environment, and even smiling.

QUESTION

1. Describe the use of a negative punishment contingency to reduce self-injury. Include:

- the person whose behavior was modified
- the undesirable behavior
- the reinforcer used
- the contingency
- the results

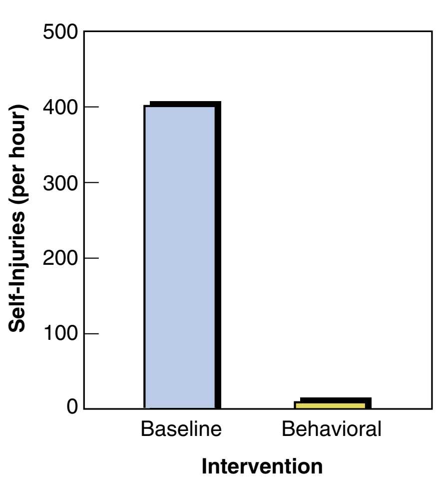


Figure 9.1 Using a Negative Punishment to Reduce a 9-Year-Old's Self-Injury

Concept

NEGATIVE PUNISHMENT (PENALTY CONTINGENCY) (G-16)

In Chapter 8, we talked about decreasing behavior with punishment by the presentation of a punisher (positive punishment). Now we need to look at punishment by the loss of reinforcers—the **negative punishment contingency (penalty)**.

Definition: CONCEPT

Negative punishment contingency (penalty)

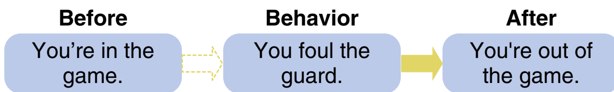
- The response-contingent
- **removal** of
- a reinforcer (positive reinforcer)*
- resulting in a **decreased** frequency of that response.

Behind the negative punishment contingency is the ***negative punishment principle***: *A response becomes less frequent if loss of a reinforcer or a decrease in a reinforcer has followed it in the past*. Note that this is a form of punishment—punishment by the loss of reinforcers (negative punishment). The other form is punishment by the presentation of a punisher (positive punishment). Also, note that the more immediate the loss or decrease, the more effective the negative punishment contingency.

The last game of the state finals. Third quarter. Your senior year. The high point of your life. You steal the ball from that obnoxious guard who has been bugging you since the start. You make a break for the other end of the court, dribbling with a speed that makes Forrest Gump look like a turtle. The crowd roars like a jet plane. The bass drummer pounds his drum so hard, he busts the drumhead. And the referee's whistle says you fouled that obnoxious guard. That's your fifth foul. You're out. And the obnoxious guard comes to give you a condescending, sportsmanlike handshake. The loss of a reinforcer—the opportunity to play in the state finals.

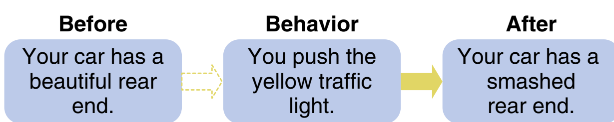
* We now have *positive* and *negative reinforcers*, which Skinner regretted; but fortunately, the compulsive terminology gods haven't yet invented the terms *positive* and *negative punishers*, to go along with *positive* and *negative punishment*. Instead we can just use *punisher* when talking about *positive punishment* and *reinforcer* (*positive reinforcer*) when talking about *negative punishment*.

Negative punishment? Let's see how often you foul obnoxious guards once you start playing college ball.



What would sports be without penalties? You lose the ball, you lose the puck, you lose the yardage. This loss of reinforcers may penalize your sloppy playing enough that you become a halfway decent player.

And here's another example: Though the light's yellow, you can make it if you floor it . . . almost. The eager beaver sneaking into the intersection smashes your car's tail end, and you lose the beauty of your car. Punishment of pushing? Could be. Some of our students argue that it may be punishment by presentation of a punisher (the smashed car), but once they realize that the smashed rear end is really just the removal of a reinforcer, intact rear end, they come around and realize it's really a negative punishment contingency.

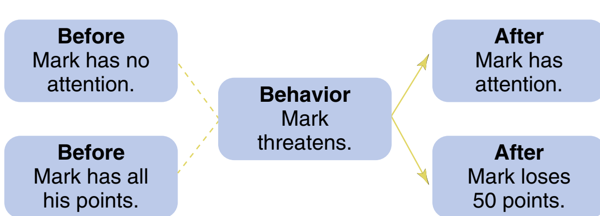


All this is bad news. But it would be worse if negative punishment didn't occur. It would be worse if you kept making the same clumsy, dumb, costly mistakes all your life. It would be worse if the loss of reinforcers didn't suppress carelessness.

Yes, boys and girls, let's all thank our friends Mr. Punishment and Ms. Penalty for making our lives livable. "Thank you, Mr. Punishment."

By the way, the reinforcer lost in a negative punishment contingency cannot be the one that's maintaining the punished response. Look at this pair of contingencies that are working concurrently (at the same time).

Inappropriate Natural Reinforcement Contingency



Performance-Management Punishment Contingency

1. Look at the reinforcer maintaining Mark's threatening behavior. Is it the one that's removed in the negative punishment contingency?
   a. yes
   b. of course not

The negative punishment contingency involves a different reinforcer from the one maintaining the penalized behavior. (In the next chapter, we will introduce the extinction procedure. With that procedure, we simply withhold the reinforcer that previously maintained the response, but that's not the same as a negative punishment contingency).

QUESTIONS

1. The principle of punishment by the loss of reinforcers—state it and give a couple of everyday examples.
2. Must the reinforcer removed by the negative punishment contingency be the same as the one maintaining the penalized behavior?

Example Behavioral Juvenile Corrections

IT AIN'T GOOD TO SAY "AIN'T"[2]

Bruce Black was back in Mae Robinson's office. "Dr. Robinson, remember the intervention we did to get rid of the verbal threats those two boys were always making in my shop?" Mae nodded. "We used a negative punishment procedure, and it worked really well," Bruce continued, "so I wonder if we couldn't use the same procedure to deal with another problem."

"What's the problem?" Mae asked.

"One of those boys, Mark, doesn't talk well," Bruce answered.

"Can you be more specific?"

"Well, his grammar's terrible."

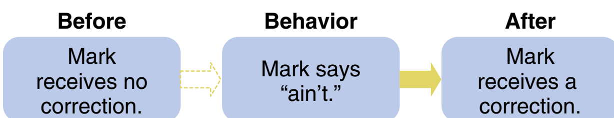
"Can you be even more specific? Can you give me an example?"

"Well, he says *ain't* all the time," Bruce said. "Now I know a person's grammar isn't as important as what the person says. And I know this may just be my middle-class prejudice. It may be more my problem than his. But it bugs me."

"It may be your prejudice, but it's also the prejudice of many other people, especially people who are likely to be employers or who can otherwise help Mark. It's OK to use street talk on the street, but if he ever wants to escape from street life to get a job, for instance, it will be much easier if he can speak standard English," Mae said.

Bruce said he'd tried correcting Mark every time he said *ain't*—a reasonable intervention to try.

Traditional Intervention



Unfortunately, this was worse than doing nothing. Mark's frequency of saying *ain't* rose from 55 per day, when Bruce had ignored it (baseline), to 74 per day with the correction procedure. This suggests that the corrections were actually reinforcing Mark's saying *ain't*. Mae explained to Bruce that Elery Phillips also had used the response-cost negative punishment contingency to reduce poor grammar at Achievement Place. So they decided to try to replicate Elery's intervention.

BEHAVIORAL INTERVENTION

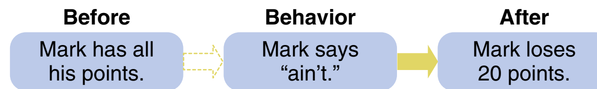
After 15 days, during which Bruce fined Mark 20 points each time he said *ain't*, the boy had completely stopped saying the word (Figure 9.2).

The Achievement Place house parents used the same negative punishment procedure and got Mark's rate of saying "ain't" down from 37 to 0 per day. A month after they had stopped the intervention, Mark was still free of the taint of "ain't."

QUESTION

1. Describe the use of a negative punishment contingency to reduce poor English. Include:
   - the person whose behavior was modified
   - the undesirable behavior
   - the reinforcer used
   - the contingency
   - the results

Behavioral Intervention



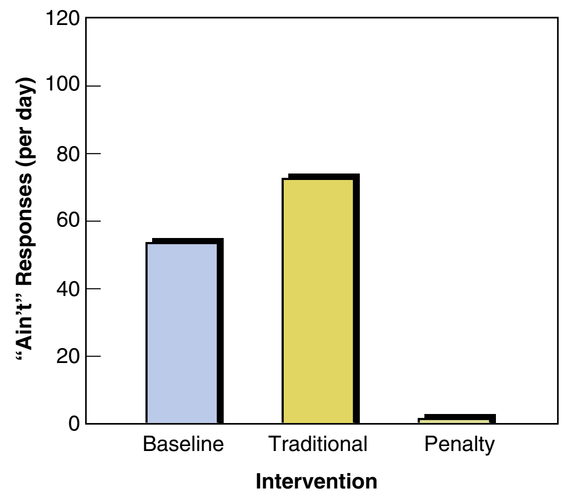


Figure 9.2 Using Negative Punishment to Reduce a Pre-Delinquent Boy's "Ain'ts"

Example Child and Family Counseling

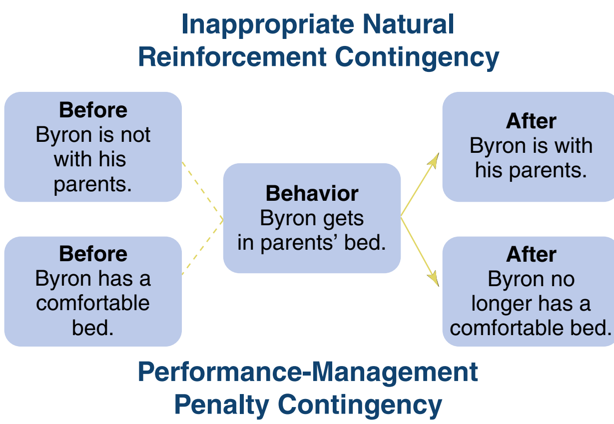
THREE'S A CROWD[3]

Oh-oh, another sleeping problem. Not Rod this time, but 5-year-old Byron. He can't sleep alone; he hops out of his bed and climbs into bed with Mom and Dad. They say "no"; they reason with him; they take him back to his own room, but soon they hear the irritating pitter-patter of the little intruder's feet as he barges into their bedroom again.

They tried reasoning with him. And they tried direct action: Mom was more permissive, but Dad would often return him to his own bed, only to wake up in the morning finding Byron had snuck back in. Often, they would reluctantly relent, move over, and make room for Byron, though they found his presence disrupting of their relationship as well as their sleep.

In the meantime, they went from psychotherapist to psychotherapist in search of help, eventually discovering a team of behavior analysts—Ayllon, Garber, and Allison. And this is the behavioral intervention they used: They would no longer scoot over to make room for Byron when he forced his way into their bed. If anything, while pretending to be asleep, they spread out a bit. If Byron was between them, they would both roll toward the center of the bed. If he climbed to one side, they would move in that direction. Initially, this tactic resulted in his accidentally falling off the bed without the parents' giving signs of having been awakened.

The inappropriate natural contingency is a positive reinforcement contingency. Byron's inappropriate entrance to his parents' bed is reinforced by their presence. But what's the performance-management contingency? Negative punishment by the removal of a comfortable sleeping arrangement.



And it worked. After just 1 week of this mild negative punishment contingency, Byron's nighttime visits dropped from 13 per week to 0 per week (Figure 9.3). Now all three sleep more comfortably.

Question: How many professional behavior analysts does it take to outfox a professional 5-year-old boy?
Answer: Three.

Question: How many traditional psychotherapists does it take to outfox a nontraditional 5-year-old boy?
Answer: More than two because two tried and failed.

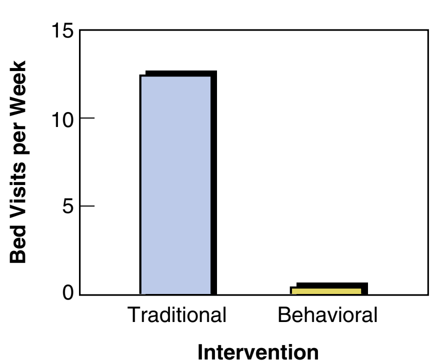


Figure 9.3 Using Negative Punishment to Decrease Poor Bedtime Behavior

And, of course, the combined efforts of Byron's two college-educated parents had been no match for him.

Incidentally, a colleague once relayed the true story of her cousin, whose daughter slept in her mom's bed until the age of 13. At that point, the daughter had outgrown such dependency and maturely informed her mother that she, the mother, would have to find her own bed in another room.

QUESTION

1. Diagram the negative punishment contingency used by Ayllon, Garber, and Allison for getting rid of a child's inappropriate nighttime visits.

Concept

RESPONSE COST

Response cost is the name for the particular negative punishment procedure Mae and Bruce used when they reduced the verbal threats and "ain't." It's the price you must pay for bad behavior, but it's like fly now and pay later: You pay the price after the bad behavior rather than before.

Definition: CONCEPT

Response-cost contingency

- The response-contingent removal of
- a **tangible** reinforcer
- resulting in a decreased frequency of that response.

By *tangible reinforcers* we mean food, money, points, tokens, and the like.

QUESTION

To get praise from the coach, the athletes must do 100 push-ups. Is the requirement of 100 push-ups an example of *response cost?*

OUR ANSWER

No, that's a *response requirement*, not a *response cost*. That's the effort of the response class, not the removal of reinforcers. Doing 100 push-ups may be aversive, but it's not a negative punishment procedure like response cost. Effort isn't response cost, as behavior analysts use the concept.

QUESTION

The coach hears one of the players using foul language in the middle of the game and immediately sends her to the showers. She never swears again, at least not within earshot of the coach. Is that *response cost?*

OUR ANSWER

No. The coach removed an *activity* reinforcer (playing the game), not a *tangible* reinforcer such as money. The swearing did become much less frequent, so it was a negative punishment procedure. But not the kind called *response cost*; we'll see shortly that it's called *time-out*. We will look at another example of response cost in the next section.

QUESTION

1. *Response-cost contingency*—define it and show how the intervention to reduce threats meets the three criteria needed for that procedure to be response cost. Also, diagram the contingency for that example.

Example Behavioral Child and Family Counseling

THE JOYS OF MOTHERHOOD[4]

"Dr. Baker, I try to love Sam, like every mother should. I try, but I can't. I hate my son. He makes our lives miserable. How can a 4-year-old boy destroy a family?"

Even if she didn't have a PhD with a specialty in behavior analysis, Dawn Baker would have had no trouble answering Mrs. Spade. In the first 15 minutes of their interview, Sam had answered the question himself. Not only was he making his parents' lives miserable and destroying their family, he was also making this interview miserable and destroying Dawn's newly decorated office. Though Sam's mother often told him to quit his destructive disruptions, Sam had managed to smash one flowerpot, knock over a chair, rip the cover off the latest issue of the *Journal of Applied Behavior Analysis*, lick the window, spit at his mother, scream, and conspicuously wet his pants.

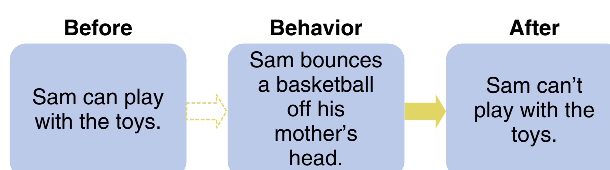
"Mrs. Spade, why don't we all go into the play-therapy room, next door," Dawn said. Dawn and Mrs. Spade sat at the plain table, doing their best to continue their interview, while Sam did his best to destroy the indestructible toys he quickly scattered about the floor.

"Mrs. Spade, I think we should try a time-out procedure with Sam. If it's OK with you, I'd like to start it now."

"Please do!"

Dawn stood up, took a child's chair and placed it in the corner, facing the wall. At that moment, Sam was standing in the middle of the room, screaming and stamping his foot on the floor. Dawn calmly said, "No, Sam. Go to the time-out chair." Then she took the child by the hand and led him to the chair. She moved all the toys away and stood directly behind him. Every time he turned his head or started to get up, she guided him back onto the chair and turned his head back to the wall. After 2 minutes had elapsed, she said, "OK, Sam, you can go play quietly now."

Sam played quietly for 15 seconds before he started bouncing a child's basketball off his mother's head. So he and Dawn cycled through the time-out again. And they went on in this way for the rest of the interview. Dawn explained to Mrs. Spade the time-out procedure for Sam's disruptions, and she demonstrated the use of time-out every time Sam disrupted.



In nontechnical terms, Dawn explained that *time-out* is a procedure for getting rid of bad behavior—a punishment procedure based on the loss of reinforcers (negative punishment). So *time-out* means time out from the reinforcers that are normally available, like the toys in the playroom.

The results: As soon as Sam had started tearing the heck out of Dawn's office, she automatically started recording baseline (so she had something with which to compare her intervention). During the first 15-minute intervention session in Dawn's playroom, time-out produced an amazing drop in disruption. With time-out contingent on disruption, Sam immediately went from disrupting 60% of the time to disrupting only 3% of the time (Figure 9.4)!

And he maintained that low level of disruption during the remaining sessions of Dawn's intervention. Mrs. Spade was ready to nominate Dawn for president of the United States.

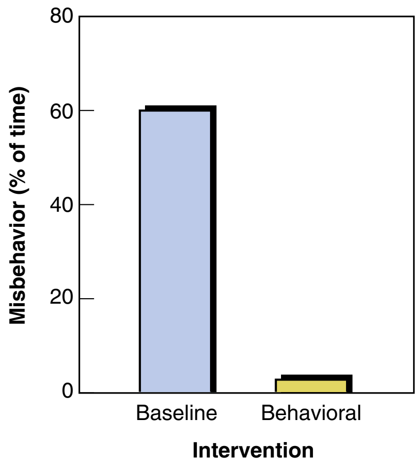


Figure 9.4 Using Time-Out to Reduce a Child's Disruption and Destruction

QUESTION

1. Describe the use of time-out to reduce disruptive and destructive behavior. Include:
   - the person whose behavior was modified
   - the undesirable behavior
   - the reinforcer used
   - the contingency
   - the results

Concept

TIME-OUT

Both at home and at school, many behavior analysts find time-out to be an excellent procedure for getting rid of bad behavior in young children. Generally, they combine time-out contingent on bad behavior with reinforcement contingent on good behavior. For example, Dr. Lynn Clark recommends time-out to get rid of biting, screaming, swearing, back talk, fighting for control over the TV, refusal to eat, hurting pets, playing in the street, throwing food, name-calling, and persistent pestering.[5]

Lynn suggests that time-out is effective, fast, easy to use properly, helps parents and teachers get rid of bad behavior without themselves becoming too angry and upset, improves the relations between the child and the adults, and clears the air for the child to acquire good behavior. He advocates it as a fast, clean way of getting rid of problems without many hassles between the child and the adult. Everyone feels better than in the more traditional nagging and bickering ways in which so many parents and children interact.* Time-out has rapidly become a popular intervention used by many parents. You may have seen the nannies on a few popular TV shows using this technique with many of the families they helped. Notice that time-out and other behavioral techniques are largely responsible for the changes in the children's behavior on those shows.

Of course, something like **time-out** is nothing new. For years, a variation on this theme has been used in sports. The best example is hockey: Violate a rule and it's time out of the game and into the penalty box. Without straining too much we can see other examples: Three strikes and you're out at bat. Six fouls and you're out of the basketball game. One swear word at the referee and you're out of any game.

But don't confuse the behavioral use of time-out with solitary confinement in prison or the usual penalties in sports. In performance management, we don't put the kid in time-out and throw away the key. We don't even kick the kid out of the game. *Usually, a brief time-out of just a couple minutes or so will do the trick*; as soon as we can, we let the kid get back into the normal, richer environment where he or she can have a chance to acquire a good, healthy repertoire.

Is this *time-out*? "Johnny, you're making too much noise here in the classroom. Go out to the playground, and stay there until I tell you to come back in." Time-out? Maybe not. It might be reinforcement. There's a good chance Johnny will find more reinforcing activities on the playground than in the classroom. So the teacher may be reinforcing disruptive behavior by making access to a more reinforcing environment contingent on that behavior. It may be naïve and even egotistical for the teacher to assume the playground is less

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* How long should time-out be? It is often recommended that the length of the time-out should be determined by the child's age—optimally, 1 minute per year of age; but that doesn't impress me. When working with a 4-year-old autistic child, 15 seconds will often do the trick, and 4 minutes would unnecessarily take too much time away from the valuable discrete-trial training. And my guess is, a 15-second non-exclusionary time-out would work pretty well with me, too, if you pinched the straw on my fruit smoothie for 15 seconds, every time I made a rude slurping noise, for example. Here's a reply from the experienced and wise Bobby Newman: I don't use any kind of formula for figuring out how long time-out should be. I generally use 30 seconds, 2 minutes, or 5 minutes, usually depending on how "out of control" the person is when they're coming to time-out, and also how reinforcing the activity they left is. More important to me is the termination of time-out. If they don't "have it together" when the timer rings, I say "I'm sorry, you need to get it together. I'll set it for one more minute and then we'll see." I rarely have to reset the timer more than once.

reinforcing than his or her classroom. This is often a danger when you try time-out.

Here's a formal definition of time-out:

Definition: CONCEPT

Time-out contingency

- The response-contingent removal of
- **access to** a reinforcer
- resulting in a **decreased** frequency of that response.

Behavior analysts sometimes distinguish between two types of time-out: *exclusionary* time-out and *non-exclusionary* time-out. *Exclusionary time-out* means the person is excluded from the immediate setting—for example, by having to go to a separate room for a couple of minutes. *Non-exclusionary time-out* means the person remains in the immediate setting during time-out, for example, by sitting in a chair away from the regular activities. Sam's case involved non-exclusionary time-out; Dawn put the time-out chair in the corner of the playroom.

QUESTIONS

1. *Time-out contingency*—define it and diagram a couple of examples where parents might want to use it.
2. Show how the previously described intervention to reduce Sam's disruptive behavior meets the three criteria in our definition of time-out.
3. How does time-out differ from solitary confinement and penalties in sports?
4. Compare and contrast exclusionary and non-exclusionary time-out.

Example Behavioral Special Education

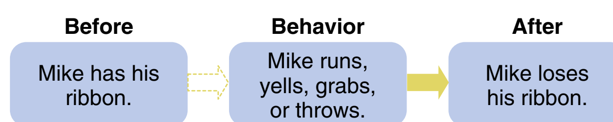
THE TIME-OUT RIBBON[6]

Mike was 8 years old, and he had an IQ of 27; he lived in a state institution structured around cottage living. He and four other low-functioning boys attended a special education classroom in a room of their cottage. They met for an hour and a half each day—an hour and a half of chaos. Mike was so hyperactive (i.e., overly active) he was completely off the wall, running around the classroom yelling and throwing everything he could grab. For the 7 months of the class, the teacher, with all her reprimands, could do nothing.

Foxx and Shapiro were at the University of Maryland, Baltimore County, during this time, and they came to the teacher's aide. Punishment seemed a reasonable intervention, but neither shock nor traditional time-out was too popular in the institution. Maybe *non-exclusionary time-out* (time-out without being excluded) would be more socially acceptable.*

So they collected baseline data for 7 days. Then they started an added reinforcer phase for 10 days. During this phase they asked the teacher to give each child a smile, praise, a touch, or a small snack about every 2 1/2 minutes. (Note that this isn't exactly reinforcement, because the reinforcer delivery is not contingent on any specific behaviors; instead, it's based on time.) They were going to use time-out in the next phase, so they had to make sure they had a reinforcing environment to time the boys out of. The frequency of reinforcers had to be high enough so that it was aversive not to be allowed to participate in it. The reinforcer-plus-time-out phase lasted 12 days.

During the phase with the noncontingent reinforcer and the following phase with time-out in addition to the noncontingent reinforcer, each boy, including Mike, wore a colored ribbon around his neck, in the style of a bolo tie. But when a boy started acting up, the teacher would take the ribbon away from that boy for 3 minutes. During that time, he got no reinforcers.



This was non-exclusionary time-out because the boy stayed in the classroom; he wasn't excluded from it. If, instead, the teacher had put the boy in the hallway for 3 minutes, that would have been exclusionary.

* Incidentally, some people call non-exclusionary time-out *contingent observation*. We prefer *non-exclusionary time-out* because *contingent observation* implies that the procedure is contingently adding something rather than contingently removing. In other words, it implies that the opportunity to observe the activity is contingent on misbehaving. This is not true because the student could also observe the activity he was participating in, before his inappropriate behavior.
But terminology anarchy doesn't end there. Some use *seclusionary time-out* rather than our *exclusionary time-out* and, even more confusing, *exclusionary time-out* for our *non-exclusionary time-out!* I guess the bottom line is that you will need to be careful to make sure you and whomever you're talking to or reading understand each other.

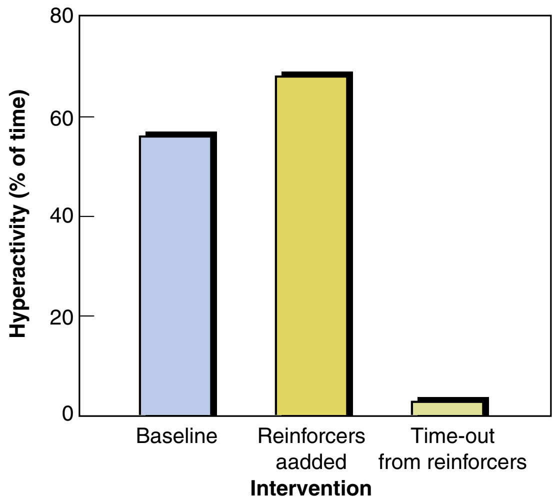


Figure 9.5 Using Time-Out to Reduce Hyperactivity

How'd it work? Like a charm. The boys were noisy and unruly when they first entered the classroom each day. They quieted down as soon as they put on their ribbon ties (Figure 9.5). A behavioral charm. (Incidentally, you should probably not take seriously the slight increase from the baseline to the reinforcer condition, because that increase is probably just random fluctuation in the data and not a reliable, significant change in frequency.)

Keep in mind that for any time-out procedure to be effective, the activity or environment the student is removed from must be reinforcing.

QUESTION

1. Describe a behavioral intervention using non-exclusionary time-out to reduce hyperactivity. Specify:
   - the response classes
   - the negative punishment contingency
   - the presumed reinforcers
   - the contingency diagram
   - the results
   - any other interesting feature of the intervention

Compare and Contrast

NEGATIVE PUNISHMENT VS. THE THREE OTHER BASIC BEHAVIORAL CONTINGENCIES

This contingency table summarizes the relations among the four basic contingencies. For example, select "remove" from the top row, "reinforcer" from the far-left column, and "negative punishment (frequency decreases)" from the corresponding cell. This means: *The contingent removal of a reinforcer is a negative punishment contingency, and it causes a decrease in frequency*.

1. What do ⇑ and ⇓ mean?

Contingency Table (final)

Stimulus	Present	Remove
Reinforcer	Positive Reinforcement ⇑	Negative Punishment ⇓
Aversive Condition	Positive Punishment ⇓	Negative Reinforcement ⇑

Here's the other form of essentially this same table. If you remove a stimulus (a cell from the row across the top) and the response frequency decreases (a cell from the column along the left), then you've got a negative punishment contingency (corresponding inside cell), which you can call *punishment by stimulus subtraction* (S^{P-}) or penalty.

Contingency Table (final)

	Present Stimulus	Remove Stimulus
Response Frequency Increases ⇑	**Positive Reinforcement Contingency** Reinforcement by stimulus addition (S^{R+})	**Negative Reinforcement Contingency (Escape)** Reinforcement by stimulus subtraction (S^{R-})
Response Frequency Decreases ⇓	**Positive Punishment Contingency** Punishment by stimulus addition (S^{P+})	**Negative Punishment Contingency (Penalty)** Punishment by stimulus subtraction (S^{P-})

We have two punishment contingencies: One, involving the presentation of a punisher, we call *positive punishment*; the other, involving the removal or loss of a positive reinforcer, we call *negative punishment* (or *penalty*). We can decrease behavior either by presenting aversive conditions (punishers) or by removing positive reinforcers, contingent on that behavior.[7]

We also have two reinforcement contingencies: One, involving the presentation of a reinforcer, we call *positive reinforcement* (or just *reinforcement*), and the other, involving the removal of a negative reinforcer, we call *negative reinforcement* (or *escape*). We can increase behavior either by presenting a positive reinforcer or by removing a negative reinforcer contingent on that behavior.

So, we can use a positive reinforcer to either increase or decrease behavior, depending on whether we present or remove the positive reinforcer. And we can use an aversive stimulus to either increase or decrease behavior, depending on whether we remove or present the aversive stimulus. (Remember we call that aversive stimulus a *negative reinforcer*, when we use it in an negative reinforcement contingency, and a *punisher*, when we use it a punishment contingency—whew!)

As you've seen in earlier chapters, we have two contingencies involving the addition of something—one, involving the presentation of a reinforcer, we call *positive reinforcement*; the other, involving the presentation of an aversive stimulus, we call *positive punishment*. We can use presentation contingencies to either increase or decrease behavior, depending on whether we present a reinforcer or an aversive stimulus.

We also have two contingencies involving the removal of something: One, involving the removal of an aversive stimulus, we call *negative reinforcement* (or *escape*); the other, involving the removal of a reinforcer, we still call *negative punishment* (or *penalty*). (No big surprise here.) We can use removal contingencies to either increase or decrease behavior, depending on whether we remove an aversive stimulus or a reinforcer (see Figure 9.6).

QUESTIONS

1. Construct the complete, final contingency table of the four basic contingencies, all properly labeled. You must understand it; memorizing won't get it.
2. Draw, fill in, and explain the tree diagram of the four basic behavioral contingencies.

Example of Time-Out Behavioral Medicine

HELPING A BABY WITH COLICKY BEHAVIOR[8]

Jenny: Since she was 2 weeks old, April's been crying day and night. Her constant crying, her piercing shrieks, are driving me crazy. I get so angry, I want to beat her. I feel like abusing her.

Dawn: I know how you feel. Constant crying often causes child abuse.

Jenny: My husband, Alex, and I haven't been able to get any sleep. Alex goes to work so sleepy he almost fell off the scaffolding at his construction site. And now he's started sleeping over at his mother's so he can get a decent night's rest. And I'm about ready to divorce him. When he comes for supper all we do is listen to April cry and fight with each other. He says April's crying is my fault—I'm too nervous and uptight.

Dawn: Well, that's one popular theory—it's Mom's fault. But the scientific research doesn't support that theory.

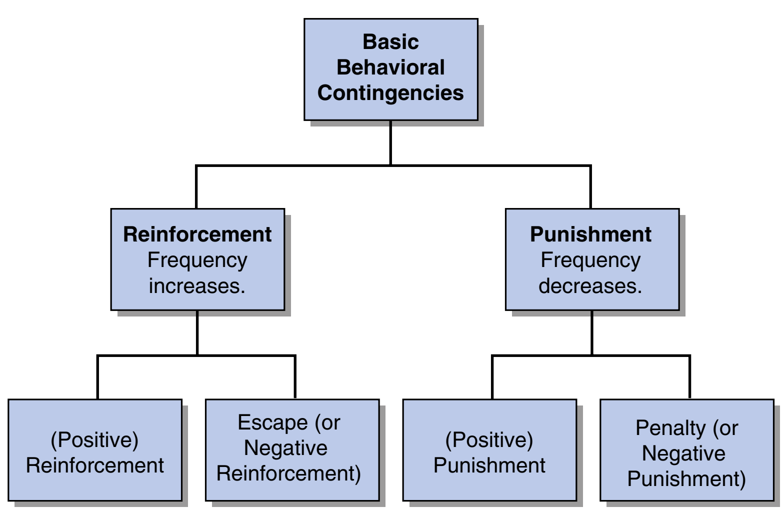


Figure 9.6 Tree Diagram of the Four Basic Behavioral Contingencies

Jenny: I don't know. I feel so guilty, like a bad mother. I told my pediatrician she had to give April something or give me something. So we tried all sorts of drugs with April, like Mylanta, gas drops, and probiotics. Nothing helped, at least not much. Now April's 5 weeks old and she just keeps shrieking. It's horrible. It breaks my heart.

Dawn: Yes, I know, you're all having a rough time. That's not an easy thing, what you're going through. This may be the hardest time in your life.

Jenny: I don't know what to do; my pediatrician says no medical condition is involved, no severe constipation, no gastroesophageal reflux, no intussusception, I think she called it—nothing to cause April to scrunch up and act like she's got severe abdominal pain. My pediatrician says it's colic. Do you think my baby has colic, Dr. Baker?

Dawn: Well, as the pediatrician Dr. William Sears put it, *colic is something a baby **does**, not something it has*. He's got a point. We should talk about the colicky behavior, not the colicky baby. It's a behavior problem; not a medical problem. A baby who is said to *have colic* is just one who cries and is irritable much of the time.

Jenny: I guess that's why my pediatrician referred me to you. She said you were a behavior analyst.

Dawn: There is no known physiological, anatomical, or medical cause of colicky crying. In fact it seems so unlikely that one will be found that medical researchers have pretty much stopped looking.

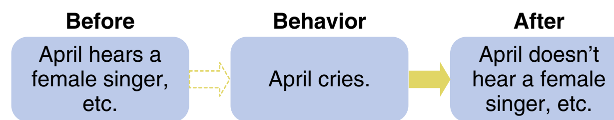
Jenny: Everyone's told me it's because poor little April has too much gas in her stomach, and that was hurting her and making her cry. I will say Alex did his best, too. He put warm towels on her stomach, held her under warm showers, and even took her for midnight car rides. Nothing helped much. I did things like put her on top of a running clothes dryer, swing with her, and just hold her and try to love her with all my heart. Still nothing helped.

Dawn: An English researcher, Dr. Illingsworth, has shown that babies who act colicky have no more gas than those who don't. Again, it looks like colic is neither a disease nor an illness. It's just a way of behaving; it's just excessive crying.

Jenny: Doctor, we'll do anything you say. Just help us, please.

Dawn: Well, here's what I'd like you to try:

- Get a CD player and a CD of your favorite singer. Then, keep the music on as long as April is awake and quiet for at least 30 seconds. You should also interact with her at those times—look at her, talk softly to her, rock her, play with her, be loving and affectionate.
- But as soon as she starts to cry, turn off the CD player and take care of any needs she might have, like feeding her or changing her diaper.
- If she keeps crying, put her in your portable infant carrier. She should stay there for 3 to 5 minutes—longer if she keeps crying. We call this time-out. Withdraw either music or attention during time-out.



And it worked the very first day Jenny began the time-out procedure (sometimes it takes a few days, but rarely as long as a week). Even 2 months later, when Dawn did a follow-up to evaluate the maintenance of the behavior change, April was fine, crying no more than is typical for a baby her age (Figure 9.7).

Jenny: I sure do thank you, Dr. Baker. Now, April, Alex, and I are happy being together. Now I love my baby and feel like a normal mother. I feel as if we have a normal family again.

Here's an interesting point: *No one in the history of medicine or in the history of psychology had been able to solve the problem of colic—not until Larson and Ayllon applied behavior analysis to its solution*. Imagine that. Impressive. Just a simple, little time-out intervention—though a very creative time-out intervention. Most of us may not be as clever and creative as Larson and Ayllon, but looking at the world from a behavior-analysis perspective can help us understand and solve many problems that traditional approaches have failed to solve.

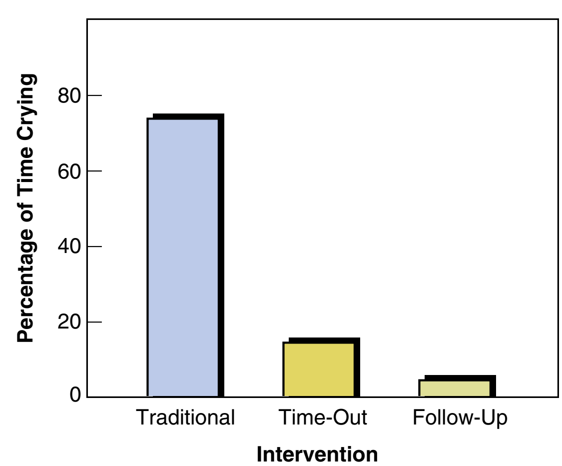


Figure 9.7 Using Time-Out to Reduce Colicky Crying

QUESTIONS

1. Diagram the contingency Dawn used to help April stop her crying (Larson and Ayllon).
2. What kind of contingency is it?

   a. positive reinforcement
   b. negative reinforcement (escape)
   c. positive punishment
   d. negative punishment (penalty)

(Yes, you're on your own in terms of answering this one. We've taken off the training wheels. No hints.)

Example of Time-Out

Behavioral Medicine

HELPING A FAILURE-TO-THRIVE BABY[9]

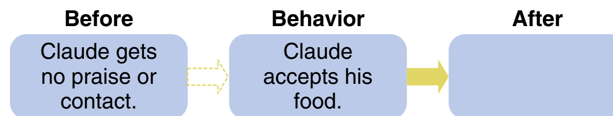
About one out of seven failure-to-thrive infants dies. This is serious business. They don't eat properly; and as a result, they lose weight, they don't grow, they become dehydrated, their electrolytes become imbalanced, and they die. For one-third of the failure-to-thrive infants, there is no known physiological, anatomical, or medical cause. These cases are called *nonorganic*. And *behavior analysis seems to hold the only solution for nonorganic failure-to-thrive babies*; nothing else works.

Consider Claude's case: He was 21 months old "with nephrogenic diabetes insipidus, a congenital hereditary disorder in which the kidneys do not respond properly."

Claude was in the hospital for the fourth time because of his failure to thrive. He wouldn't eat much, and he would vomit or spit out most solid food he did eat. For the last 16 months, he had been put on nasogastric (nose to stomach) tube feeding to keep him alive. In the hospital, they tube fed him 15 hours a day and kept him on four different drugs. In spite of Claude's kidney problem, his failure to thrive seemed to be nonorganic. He had to eat normally in order to gain the weight he needed to survive the surgery for his kidney problem.

Suppose you are now a professional behavior analyst and you're called in to help Claude. First, you would ask if Claude needs to increase appropriate behavior or decrease inappropriate behavior. Claude needs to do both. He needs to increase his acceptance and eating of food that is given to him. So please fill in the following positive reinforcement diagram.

Reinforcement Contingency for Eating

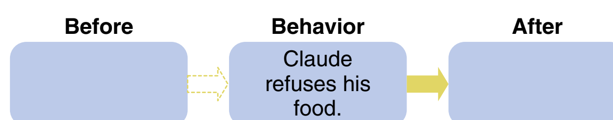


Positive Reinforcement Contingency for Eating

Every time Claude accepted and ate a bite of food, his mother would praise him and run her fingers up and down his arm, tickle his stomach, or rub his knees. Of course, he would get none of that if he didn't accept his food.

But you might also use a time-out contingency to decrease Claude's refusal of his food. (His refusal consisted of clenching his mouth shut and shaking his head back and forth.) You might dig out your old copy of *PoB* and review the contingency Dawn used with April; so diagram the following performance-management contingency, using exactly the same contingency as April's (except make allowance for Claude's mother's preference for Elvis Presley).*

Time-Out Contingency for Refusing to Eat



Not only did Claude's mother turn off the music immediately, but she also said "*No*" firmly, removed Claude from his chair, put him in his crib, turned her chair away, and refused to look at him. After 3 minutes without crying, she would put him back in his chair and continue with his meal.

And she used the same contingency every time Claude vomited. Please diagram it.

* You might also analyze this as avoidance of the loss of a reinforcer (Chapter 17), but the behavior would be accepting the food, instead of refusing it.

Time-Out Contingency for Vomiting

How long do you think it took for these three simple contingencies to get Claude eating more or less normally? About 3 days for him to accept 89% of the bites his mother offered him. Ten days out of the hospital and Claude was eating everything he was offered (Figure 9.8).

And what about Claude's vomiting? Another success story: within 4 days he'd decreased from a baseline of six vomits a day to less than one a day (Figure 9.9).

During baseline (the traditional intervention), Claude

> emitted deep, loud, coughing and gagging noises, and demonstrated repeated voluntary contractions of his stomach muscles that would induce vomiting. However, after 5 behavioral feeding sessions, he no longer emitted vomit-inducing behavior. Additionally, he appeared happier and more pleasant at mealtime and no longer kicked and screamed during feeding sessions. . . . Thirteen months after Claude's hospitalization, he had shown significant and constant improvement and had undergone a successful kidney transplant.
>
> (p. 46)[10]

Imagine how powerful a little positive reinforcement contingency and a couple of time-out contingencies can be. They can solve a problem that has baffled the medical profession from the beginning.

How would you feel if you were able to make such a significant positive impact on the life of another human being and his family, perhaps even saving that life? Well, here's the deal: The world is full of little Claudes and darn few behavior analysts. What are your plans for the next few years?

QUESTIONS

1. Diagram the three contingencies Larson, Ayllon, and Barrett used to help Claude become a thriving baby.
2. Label each contingency.

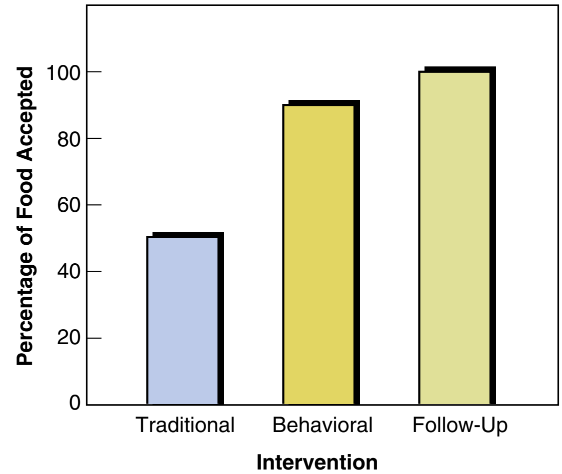


Figure 9.8 Using Positive Reinforcement and Time-Out to Increase Food Acceptance

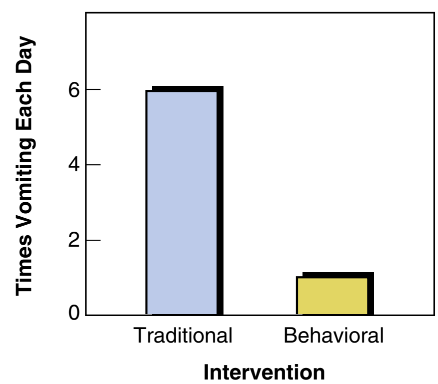


Figure 9.9 Using Time-Out to Decrease Vomiting

Sid's Seminar

ROLLING OVER THE DEAD MAN

Sid: Who's got a good example of positive reinforcement in everyday life?

Tom: My girlfriend gives me a backrub when we're watching TV, as long as I'm not making sexist comments about her beloved reality TV stars.

Sid: What behavior are you analyzing?

Tom: My not making sexist comments.

Joe: No, that fails the dead-man test; dead men don't make sexist comments either. And if a dead man can do it, it ain't behavior.

Tom: So, how do I fix it?

Joe: Roll the dude over.

Tom: Huh?

Sid: First, you roll over the behavior. You make the behavior the opposite of what you have. What's the opposite of not making sexist comments?

Tom: Making sexist comments. But that doesn't work: I make sexist comments and my girlfriend gives me a backrub?

Sid: Right, you have behavior because dead men don't make sexist comments. And you're right, that contingency's not what you want. So now you roll over the contingency; what's the opposite of "my girlfriend gives me a backrub"?

Eve: My girlfriend stops giving me a backrub.

Sid: Right, and that's what goes in the after condition. Of course the opposite goes in the before condition—my girlfriend is giving me a backrub. So let's diagram the whole contingency.

Before	Behavior	After
My girlfriend is giving me a backrub.	I make a sexist comment about what's on TV.	My girlfriend stops giving me a backrub.

Joe: So when we roll over the dead man, we find he's lying on a negative punishment contingency—punishment by the loss of backrubs.

Sid: We roll over the dead man by first rolling over the non-behavior (making it the opposite of what we thought we had and, thus, making it real behavior). And then we roll over the after condition (making it the opposite of what we thought we had). And we find that our correct contingency is also the opposite of what we thought we had; for example, the opposite of positive reinforcement is negative punishment. Let's try one more.

Tom: OK, how about this one: After I eat dinner at my girlfriend's, I'm lying on the couch, and I don't move; so she doesn't ask me to do the dishes. That's like, ahh, avoiding doing the dishes.

Sid: What's the behavior you're analyzing?

Tom: Not moving; it allows me to avoid the aversiveness of doing the dishes.

Joe: That one fails the dead-man test, too; dead men are experts at not moving, at least not without a little help from their friends.

Sue: Obviously you've never seen *Night of the Living Dead* . . .

Tom: So, how do I fix this one?

Max: Let me say it this time: You roll over the dead man. And you roll over the dead man by first rolling over the non-behavior (making it the opposite of what you thought you had, thus, making it real behavior). Then you roll over the after condition (making it the opposite of what you thought you had).

Sid: Our readers have been sitting there patiently; why don't we give them a turn?

1. Dear reader, would you mind filling in this diagram for the pseudo sleeping beauty?

Before	Behavior	After

2. And we find that our correct contingency is also the opposite of what we thought we had; for example, the opposite of negative reinforcement is
   a. reinforcement by the presentation of a reinforcer.
   b. punishment by the presentation of an aversive condition.
   c. penalization by the removal of a reinforcer.

Sid: And what do we do when we find the dead man, boys and girls?

Boys and Girls: We roll him over, Mr. Fields.

Sid: And how do we roll him over?

Eve: We roll over the behavior, and we also roll over the before and after conditions by reversing them. So we end up with "Don't have to do the dishes, get up from couch, have to do the dishes."

Example of Negative Punishment Behavioral Special Education

JIMMY, THE CHILD WITH AUTISM[11]—PART V

Amy and Kate were sitting at the kitchen table, discussing Jimmy's recent progress. Having just finished his session with Kate, Jimmy now sat in the living room watching his favorite TV show, *Thomas the Tank Engine*. He hummed along with the theme song, and his face lit up as the familiar characters appeared on the screen. But . . .

Amy: Jimmy's hand flapping still bothers me, Kate. He's been making so many gains, but that stimming still makes him stick out like a sore thumb.

Kate: I agree that he's been doing very well lately, Mrs. Lewis. And I agree with you about his stimming. Those kinds of behaviors can be very hard to get rid of. They have been a reliable source of positive reinforcement for Jimmy for a long time. And automatic reinforcement like that is always available.

Kate went on to present a few options for dealing with automatically reinforced, self-stimulatory behaviors. One option is to modify the contingency by preventing the outcome. This is often difficult; but in the next chapter, we'll see that Mae and Sue successfully implement it at Jimmy's school. Of course, the two most obvious ways to decrease the frequency of a behavior involve punishment. Kate and Amy agreed that they would avoid using positive punishment unless the behavior really got out of hand. Since Jimmy's flapping wasn't a physical danger to himself or others, it would be better to first look for other solutions than old-fashioned punishment.

But, as we've seen, there is the second type of punishment—**negative punishment**. If they could set up a situation where Jimmy lost a reinforcer whenever he stimmed, that should reduce the stimming.

Kate: I wonder what we could use as a reinforcer that we can control and take away when we need to.

Amy: Well that's easy; just look at what he's doing right now. Jimmy loves watching TV, especially *Thomas the Tank Engine*. Jack and I have to keep a close eye on how much we let him watch TV, because he'd sit there forever if we let him.

Kate: Contingent TV removal is a great idea! Here's what we can do. Any time you can, sit down and keep a close eye on Jimmy, then let him watch TV. If he's sitting nicely, then he can watch as much as he wants, within your normal limits of course. But if he stims, immediately turn off the TV. That will be our negative punishment contingency. And once he stops stimming, count silently to five and turn the TV back on.

Before	Behavior	After
Access to favorite show.	Jimmy stims.	No access to favorite show.

Kate would also use a similar contingency during her sessions to work on the same problem. She had an iPad that she occasionally used as a reinforcer for Jimmy. It had some kid-friendly games on it, and it could also play music and video clips. Kate decided she'd sometimes let Jimmy watch clips of Thomas during her sessions. But as soon as he started flapping his hands, she'd flip the iPad over so he couldn't see the screen. When he stopped, she'd wait a few seconds and flip it back over.

And the negative punishment contingency worked, at least in those settings. Jimmy quickly stopped flapping his hands when watching television or video clips on the iPad. Of course, Kate, Mae, and Jimmy's parents would have to come up with other interventions to stop the stimming in other situations, but this was a good first step. (Warning from the trenches of the real world: Sometimes it seems hard to find a reinforcer that competes with automatic reinforcers coming from self-stimulation, but it's always worth a try.)

In the Skinner Box
Experimental Analysis of Behavior

THE BIG FOUR

Earlier in this chapter we compared and contrasted the four basic behavioral contingencies. Because they are so important to master, we'll go through the four of them one more time but with the help of our friend Rudolph the Rat.

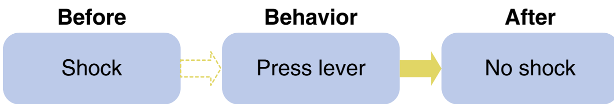
Let's start with the two contingencies that increase behavior. For *positive reinforcement* we'll need to first make sure we have a reinforcer. A little bit of sugar water should do the trick for Rudolph, just as it does for many of us. We present the reinforcer whenever he presses the lever, and lever pressing will increase.

Positive Reinforcement

Before	Behavior	After
No sugar water	Press lever	Sugar water

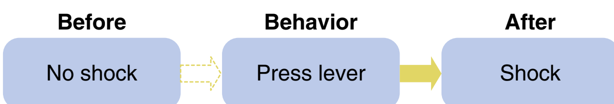
But there's more than one way to skin a cat, and there's more than one way to reinforce a rat. The other way to increase a behavior is with a *negative reinforcement (escape) contingency*. This time we need to identify a negative reinforcer. A mild electric shock will be quite effective. Once the shock is turned on, Rudolph can turn it off by pressing the lever. After a little exposure, he will soon be a lever-pressing expert.

Negative Reinforcement



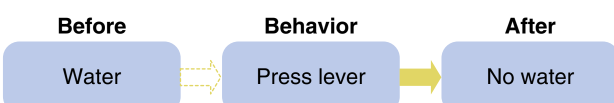
And we have two basic contingencies that can reduce behavior. Let's start with *positive punishment*. We've identified the shock as an aversive condition. But this time, instead of removing it contingent on a behavior, we will present it. If we present the shock after lever presses, they will become less frequent.

Positive Punishment



The fourth contingency also reduces the frequency of behavior. *Negative punishment (penalty)* is removing access to a reinforcer contingent upon the behavior. In this case, Rudolph might have access to a hopper full of water, which he can drink freely. But when he presses the lever, the water is removed. Lever pressing will go down in frequency.

Negative Punishment



Remember that for a positive punishment contingency, there will also be a reinforcement contingency of some sort working in the background that got the behavior going in the first place and keeps it going at some level. The same is true for negative punishment, which you will see in the next section.

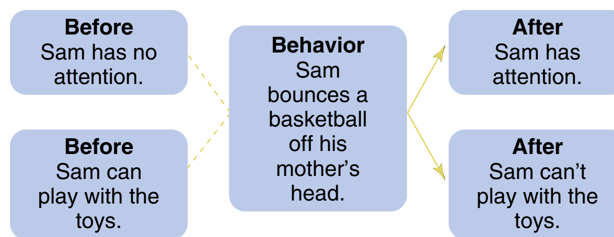
FOR EVERY NEGATIVE PUNISHMENT CONTINGENCY, THERE'S A REINFORCEMENT CONTINGENCY IN THE BACKGROUND

Remember, we made a parallel point in Chapter 8:

Whenever you have a negative punishment contingency you must also have a reinforcement contingency.

For punishment to occur, you need behavior; and for behavior to occur reliably, it must be reinforced. Now it's easy to miss this important point if you look at only the case studies we presented in the earlier sections. In most of those cases, we knew the strange behaviors occurred at high rates. We didn't ask why they occurred. But if they occurred, you can be fairly sure they were producing reinforcers. In these cases, we don't know what the reinforcers were. But we assume there must have been reinforcers. Here is a guess at one, just to give you another example of what the contingency diagram looks like:

Inappropriate Natural Reinforcement Contingency



Performance-Management Penalty Contingency

In any case, whenever you use a negative punishment contingency, you should keep your eye on the reinforcement contingency as well. Nowadays, behavior analysts often do a functional assessment to find the undesirable reinforcement contingency. Then they can counteract that undesirable reinforcement contingency one way or another; for example, they might terminate the reinforcement contingency and thus extinguish the inappropriate behavior; and at the same time, they might use differential reinforcement of alternative behavior (see Chapter 11).

Ethics

THE BENEFITS OF BASIC RESEARCH

Let's take a moment to discuss the concepts of *basic research* and *applied research*. Scientists do basic research when they want to find out how the world works. They do applied research when they want to find out how they can help the world to work better. Practitioners are not necessarily doing research, but hopefully they are applying well-researched practices in their efforts to make the world work better. Practices with a solid research base are called ***evidence-based practices***. Good practitioners should always strive to use these evidence-based practices, practices that have been shown to be effective in many well-designed studies in peer-reviewed journals. Evidence-based practice is an example of how basic and applied researchers have contributed to applied work.

Most scientists doing basic research like to see the results of their work used to *help humanity*, and such uses sure help scientists justify their work to their friends and neighbors. But many scientists don't need these applications to justify their work to themselves. They consider basic research of value just because it *adds to human knowledge*, regardless of its use in human affairs.

For years, behavior analysts doing basic research insisted on working with rats and pigeons in the lab, with little concern for human applications. Before these basic researchers realized they could contribute directly to the well-being of humanity, they proclaimed the virtues of pure science and sometimes scorned those concerned with the everyday world. Still, in spite of their lack of concern, their work laid the foundations for the development of effective applications to human affairs. You've seen that, in this book. On the other hand, traditional psychologists who concerned themselves exclusively with the problems of humanity often had little success. So the scientists who seemed to care the least about the welfare of humanity may have contributed the most to it.

Now that basic researchers in the analysis of behavior see they have something to contribute to the outside world, they are as eager to make such contributions as anyone else would be. At this point, our greatest danger may be that these basic researchers have trouble resisting the reinforcing social approval involved in applied behavior analysis; then, if too many leave their "ivory towers," we may soon run out of new scientific developments to apply to human affairs.

Incidentally, if you ever have the chance to work on a basic research project, grab it! You'll soon see that these scientific problems are every bit as reinforcing to study and solve as are the problems outside the basic-research lab.

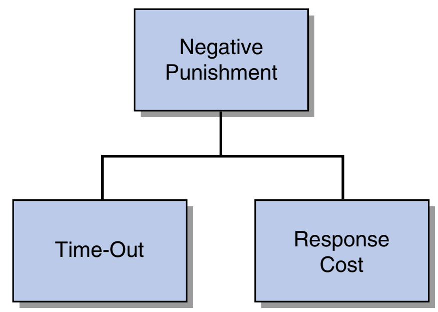
QUESTION

1. What are the two main values of basic scientific research?

Compare and Contrast

RESPONSE COST VS. TIME-OUT

The *negative punishment* contingency is the general or generic term, and response cost and time-out are the two subcategories.



We've seen the two types of negative punishment contingencies—response cost and time-out. The difference in the definitions of *response cost* and *time-out* is darn slight—only one or two words. Let's look again at the general form of the two definitions.*

Definition: CONCEPT

____

- response-contingent
- removal of
- ______________ reinforcer
- resulting in a decreased frequency of that response.

If you fill the first blank with *response cost*, then you should leave the second blank empty or write in *a tangible*. This means response cost involves the removal of reinforcers. But if you fill the first blank with *time-out*, then you should fill the second blank with *access to*. This means that time-out involves the removal of ***access*** to reinforcers. Mark lost the points he already had every time he threatened someone, so that's

* Not only is the difference between the two concepts subtle in the structure of their definitions, it's also subtle in application. Many penalty contingencies fall in a gray area, where they may, more or less, be both response cost and time-out. Nonetheless, the two concepts are in common use by behavior analysts, so we should use them as consistently as we can.

response cost. Sam lost access to all the toys on the floor for 2 minutes every time he became a royal pain, so that's *time-out*.

Here's another way to put it: Time-out is usually the removal of the opportunity to make reinforced responses. When hockey players go to the penalty box, they lose the opportunity to make reinforced responses for a period of time; that's time-out. They don't lose points they've already earned; that would be response cost.

I visited a junior high school classroom for emotionally disturbed children where Dr. Robert Hawkins had set up a behavioral incentive system called a *token economy*. The students earned tokens for constructive work and academic behavior. They lost points for inappropriate behavior. The teacher and one of the boys were playing chess. The boy made a dumb move, and the teacher captured his pawn. The boy swore. The teacher held out her hand and said, "That'll be one token." The so-called emotionally disturbed boy pulled a token out of his pocket and handed it to the teacher, without saying a word and without taking his eyes off the chessboard. That was a loss of a reinforcer, so it was a response-cost contingency. If she had said they would have to stop playing for 2 minutes because he'd sworn, it would have been a time-out contingency.

By the way, in the face of the loss of a token reinforcer, why was the so-called emotionally disturbed boy able to control himself with such cool maturity? Because if he'd argued, or thrown a tantrum, or sworn at the teacher, the behavior would not have been reinforced, and it would have cost him even more tokens! Professionals pin the label of *emotionally disturbed* on these kids, but instead, maybe they should pin the label of *emotionally disturbing* on the environments that reinforce such behavior.

Sometimes there also may be another difference: With response cost, you normally lose the reinforcers forever. For example, when the boys in Achievement Place lost points, they could never get those *specific* points back, though they could earn future points. But in some time-out procedures, the loss of a reinforcer need not be permanent. Consider this example of time-out: The parents send their daughter away from the dinner table for a couple of minutes when she pesters her little brother. But after those couple of minutes, she can return to finish the meal with no permanent loss of the food reinforcers, though she does have less time to consume them. Contrast that use of time-out with the following response-cost contingency: For the same offense, the parents might send the daughter to bed with no supper. She's lost it forever.

On the other hand, at least one of the two actual case studies we looked at involved permanent loss of reinforcers. Every 2 minutes of Sam's time-out from play represented an opportunity lost and gone forever, because Dawn had limited the length of each session to 15 minutes. So, sometimes even time-out produces a permanent loss. But response cost is almost always a permanent loss. For example, when you get a traffic ticket and must pay a fine, the violations bureau doesn't just keep your $50 for a few days and then return it to you. That response-cost-like procedure is a permanent loss of that $50, even though you may earn other $50 bills in the future.

Here's another cue: Response cost *often* involves tangible reinforcers, like tokens or money (we say *often*, because response cost might involve the loss of nontangible reinforcers such as approval, or it might involve an increase in effort). Time-out *usually* involves activity reinforcers, like playing hockey. But, again, there are exceptions.

Response Cost vs. Time-Out

Response Cost	Time-Out
Removal of the reinforcers themselves	Removal of *access* to reinforcers
Loss of reinforcers	Loss of *opportunity to access* reinforcers
Lost forever	Lost temporarily
Tangibles	Activities

Keep in mind that these criteria are just guidelines. Sometimes a negative punishment contingency will have some of the features of response cost combined with some of the features of time-out. That's life. That's the twilight zone; and when a contingency falls in the twilight zone, we don't waste too much time trying to decide if it's response cost or time-out; we just call it by its more generic and useful name—*negative punishment*.

Most of these distinctions are not hard and fast—and we don't mean to make a big deal of the overall distinction between response cost and time-out. *The big deal is that both response cost and time-out are types of negative punishment contingencies*.

So what is it?

a. Time-out?
b. Response cost?
c. Neither—it falls in the twilight zone?

It meets all the criteria in the preceding table for response cost. So that's easy.

Now, remember this one?

Before	Behavior	After
Jamal has physical contact.	Jamal bangs his chin on his shoulder.	Jamal loses physical contact.

So Jamal is losing the reinforcer itself and it is tangible, but the loss is only temporary. So what is it?

a. Time-out?
b. Response cost?
c. More or less both. It falls in the twilight zone?

QUESTION

1. Compare and contrast positive punishment, negative punishment, response cost, and time-out.

- Construct a table comparing and contrasting time-out and response cost. Remember that it's hard to get a good grade on the quizzes if you don't understand the tables and can't reproduce them.
- Recognize examples of each.

Research Methods

REVERSAL DESIGNS (D-5)

The scientist needs to know if the changes in the independent variable are responsible for the changes in the dependent variable. And the performance manager needs to know if the intervention is responsible for the changes in the client's behavior. But to know this, the scientist must look at the dependent variable when the independent variable hasn't been changed and when it has and then compare the two values of the dependent variable. And the performance manager must look at the client's behavior when the intervention is in effect and when it isn't and then compare the two performances.

That's why the baseline is so important. Remember the use of time-out from physical contact to reduce Jamal's self-injury. We showed the data for the baseline followed by the intervention and compared the two. The data looked good; Jamal's frequency of self-injury dropped from the baseline days to the intervention days.

But maybe it was just a coincidence. Maybe something else important just happened in Jamal's life at the same time. And maybe that something else was the real cause of the decrease in his self-injury. For instance, maybe the weather became more comfortable, and that caused him to decrease his self-injury. Or maybe his parents had visited him. Or maybe the dietitian had changed his diet. Or maybe any one of a thousand coincidences.

Remember from Chapter 4, the ***reversal design***? Here's a reminder:

Review Definition: CONCEPT

Reversal design

- An experimental design
- in which we reverse
- the intervention and baseline conditions
- to assess the effects of those conditions.

And in their original research, Tate and Baroff were aware of the possible 1,000 coincidences. So to rule them out, these behavior analysts used a *reversal design*. That is, they reversed their procedure: They withdrew their time-out contingency and returned to baseline conditions. Then they waited to see if Jamal would start his self-injury again. He did. So now they were more confident that their time-out contingency was responsible for the decrease in his self-injury. But, of course, they didn't want to leave Jamal in this unhealthy condition, so they intervened again with their time-out contingency. And again, Jamal's self-injury reduced to a low level. This second reversal had two benefits: It improved the quality of Jamal's life, and it made Tate and Baroff even more confident that they were not dealing with a coincidence, that the time-out contingency was responsible for Jamal's improvement. Of course there are times when the danger from the behavior outweighs the benefit of using a reversal to prove the effectiveness of your intervention.

How did the second reversal make them more confident? Maybe the changes in Jamal's behavior resulted from two coincidences. For instance, maybe the original decrease in Jamal's self-injury resulted from an improvement in the weather. And maybe the increase in his self-injury resulted from a worsening in the weather. And their first intervention and reversal just happened to occur at those times. It's possible. Not likely, but possible. So the second reversal, where they started the time-out contingency again, increased their confidence in the importance of the time-out. The odds of three coincidences in a row seemed too low to worry about.

Now Tate and Baroff could continue their use of time-out with confidence. They also could recommend that the staff at Murdock Center consider it for similar problems. And they could publish the results of their intervention with considerable confidence, so that other behavior analysts also could consider using it to help other unfortunate people like Jamal.

Question

I check my addition twice. First, I add from the top of the column of numbers down to the bottom. Then I reverse the direction and add from the bottom up. I get the same results both times. So now I'm more confident of my answer. Is this a *reversal design?*

Our Answer

No way. A *reversal design* is an *experimental design* where you compare an experimental *intervention* with a *baseline*. Adding numbers has none of those features.

QUESTION

1. *Reversal design*—define it and show how Tate and Baroff's original research on the use of time-out to reduce self-injury meets all the components of the definition.

More Details

Here are more details on the actual experimental evaluation Larson and Aylon used.

The experimental evaluation of the time-out intervention involved six different phases, with each phase usually lasting a few days (Figure 9.10).

MORE QUESTIONS

1. For the moment, look at baseline 1, time-out 1, baseline 2, and time-out 2. Do these four phases represent a reversal design?

   a. yes
   b. no

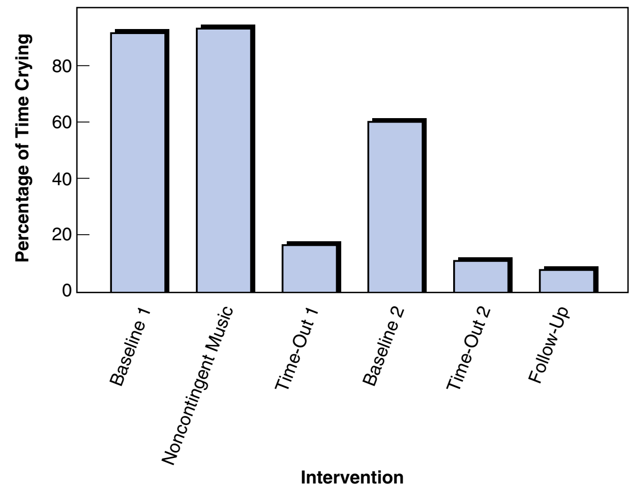


Figure 9.10 Experimental Evaluation of Time-Out and Colicky Crying

2. Please explain your answer.
3. Does that reversal design you discovered in answering question 1 increase your confidence that the time-out intervention is what actually reduced the colicky crying?

   a. yes
   b. no

4. Please explain your answer.
   To make their experimental design even better, their second phase involved the noncontingent presentation of the music. The mother turned on the music sometimes, whether or not the baby was crying.
5. Does the noncontingent presentation of the music reduce the crying?

   a. yes
   b. no

6. Please explain your answer.
7. In the noncontingent music phase, they presented and removed the music independent of whether the child was crying. Does this phase increase your confidence that the time-out intervention reduced the colicky crying? In other words, what reduced the crying?

   a. the soothing effects of the noncontingent music
   b. the music actually being contingent on crying

8. Please explain your answer.
9. The last phase is the follow-up phase. It occurred 2 months later. Here, all they did was measure the amount of crying. Does the follow-up phase increase your confidence that the time-out intervention was worth doing?

   a. yes
   b. no

10. Please explain your answer.
11. Now, please explain the function of each phase in the Larson and Ayllon experiment on the use of time-out to reduce colicky crying.

Research Methods

THE IMPORTANCE OF BASELINES (E-3)

Let's imagine what might happen if you don't use a proper research design. Sometimes you need a good design, even when you're not doing research—when you're working as a practitioner. Consider the case of Frank, a young man who was referred to the Psychology Service. He spent so many hours slapping his face, the staff had to restrain him. Before we started a behavioral intervention, we collected baseline data on his unrestrained frequency of self-injurious slapping. It was a good thing we did.

During eleven 30-minute observation periods, his frequency of face slapping rapidly dropped from over 600 an hour to nearly 0. But we hadn't done anything! This was just baseline.

Consider this hypothetical situation: Imagine we had used a pharmacological intervention in which Frank took a tranquilizer every day in the hope that this would get rid of his face slapping. And suppose we had used the drug without getting baseline data first. It would have looked as if the drug had caused the decrease in slapping. Then Frank might have unnecessarily been on that drug the rest of his life!

Moral: We often need to collect baseline data to make sure our intervention, our independent variable, is causing any changes we see in the dependent variable. It's important to be sure of what's causing what, both for scientific and practical reasons. So, as scientific researchers we need to collect baselines, and even as practitioners, we sometimes need to collect baselines (for example, physicians often withhold the prescription of antibiotics for a few days to be sure the antibiotics are needed to cure your sore throat). Practitioners may need to collect baseline data when they're not sure whether an elaborate, expensive, or potentially hazardous intervention is needed.

QUESTION

1. Give an example of the importance of collecting baseline data and what might happen if you didn't.

Notes

1 Based on Tate, B. G., & Baroff, G. S. (1966). Aversive control of self-injurious behavior. *Behavior Research and Therapy*, *4*, 281–287.

2 Phillips, E. L. (1968). Achievement Place: Token reinforcement procedures in a home-style rehabilitation setting for "pre-delinquent" boys. *Journal of Applied Behavior Analysis, 1,* 213–223. (The data we present are extrapolated from the median of their 3-hour samples to daily rates.)

3 Based on Ayllon, T., Garber, S. W., & Allison, M. G. (1977). Behavioral treatment of childhood neurosis. *Psychiatry, 40,* 315–322. Here we are presenting only one component of their intervention package.

4 Based on Mace, F.C., Page, T.J., Ivancic, M.T., & O'Brien, S. (1986). Effectiveness of brief time-out with and without contingent delay: A comparative analysis. *Journal of Applied Behavior Analysis, 19,* 79–86.

5 Clark, L. (1985). *SOS! Help for parents*. Bowling Green, KY: Parents Press (P.O. Box 2180). This is an excellent book for parents and teachers, full of many useful suggestions and guidelines, especially on the effective and humane use of time-out.

6 Based on Foxx, R. M., & Shapiro, S. T. (1978). The time-out ribbon: A nonexclusionary time-out procedure. *Journal of Applied Behavior Analysis*, *11*, 125–136.

7 Although suggesting a different solution, Stephen Ledoux concurs with our analysis of the confusion traditional terminology causes: "In everyday usage, *positive* connotes good or pleasant while *negative* connotes bad or unpleasant. As a result, people have some difficulty with the concept of a *negative* reinforcer strengthening behavior. They have even greater difficulty with the concept of *positive* punishment; they have trouble imagining much that is positive about punishment." From Ledoux, S. F. (2002). Increasing tact control and student comprehension through such new postcedent terms as added and subtracted reinforcers and punishers. In S. F. Ledoux (Ed.), *Origins and components of behaviorology* (pp. 199–204). Canton, NY: ABCs.

8 Based on Larson, K., & Ayllon, T. (1990). The effects of contingent music and differential reinforcement on infantile colic. *Behavior Research and Therapy*, *28*, 119–125. The graphed data are from Ayllon, T., & Freed, M. (1989). *Stopping baby's colic*. New York: Perigee. This outstanding book is a must for all parents whose babies have crying, eating, or sleeping problems.

9 This case is based on Larson, L. L., Ayllon, T., & Barrett, D. H. (1987). A behavioral feeding program for failure-to-thrive infants. *Behavior Research and Therapy*, *25*, 39–47.

10 Larson, L. L., Ayllon, T., & Barrett, D. H. (1987). A behavioral feeding program for failure-to-thrive infants. *Behavior Research and Therapy, 25,* 39–47.

11 Based on Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis*, *18*, 111–126.

PART VI

Extinction and Related Processes

CHAPTER 10

Extinction (Following Reinforcement) and Recovery (Following Punishment)

Behavior Analyst Certification Board 5th Edition Task List Items

B-7.	Define and provide examples of automatic and socially mediated contingencies.	Pages 170–185
B-9.	Define and provide examples of operant extinction.	Throughout
E-2.	Behavior analysts' responsibility to clients.	Pages 187–188
E-4.	Behavior analysts and the behavior-change program.	Pages 185–186
E-9.	Behavior analysts and research.	Page 187
F-3.	Identify and prioritize socially significant behavior-change goals.	Pages 186–187
F-6.	Describe the common functions of problem behavior.	Pages 170–178
F-8.	Conduct a functional analysis of problem behavior.	Pages 170–174
F-9.	Interpret functional assessment data.	Pages 171–172
G-14.	Use reinforcement procedures to weaken behavior (e.g., DRA, FCT, DRO, DRL, NCR).	Page 172
G-15.	Use extinction.	Throughout
G-16.	Use positive and negative punishment (e.g., time-out, response cost, overcorrection).	Pages 174–175, 180, 183, 187–188
H-3.	Recommend intervention goals and strategies based on such factors as client preferences, supporting environments, risks, constraints, and social validity.	Pages 187–188
H-5.	Plan for possible unwanted effects when using reinforcement, extinction, and punishment procedures.	Pages 172–175, 185–186, 188

Example of Extinction Child and Family Counseling

FAMILY LIFE—PART III: CRYING*

Remember Rod's bedtime crying in Chapter 2? Such episodes occurred so often that Dawn and Sid's life became miserable at bedtime.

"I'm beginning to think having a child was a mistake," Sid said. Sid and Dawn had just spent 30 minutes waiting for Rod to fall asleep to prevent the aversive crying. "Rod's crying really bugs me."

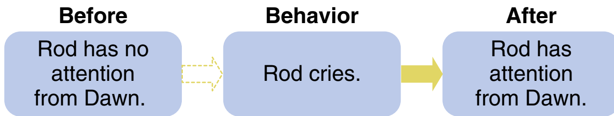
"Come on! Don't blame Rod, he's just an innocent 21-month-old baby," Dawn said.

"Maybe, but whatever happened to your idea of using your skills as a professional behavior analyst to help the three of us out of this mess?" Sid asked.

"OK, a while back you said our attention (and especially mine) might be reinforcing Rod's crying," Dawn said.

"To be more precise, our attention is *contingent* on his crying," Sid corrected.

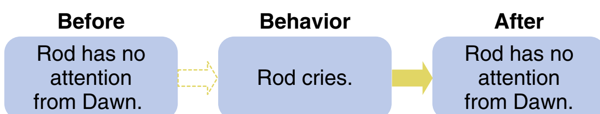
* This section and the graph are based on Williams, C. D. (1959). The elimination of tantrum behavior by extinction procedures. *Journal of Abnormal and Social Psychology, 59,* 269.



"Yes, of course. Well, I remember the classic article by Williams. He described a procedure to get rid of an infant's temper tantrums—an extinction procedure. It was simple: The parents stopped paying attention to their child's crying at night. And it worked!"

"You mean we should leave Rod awake in the bedroom by himself in spite of his crying?" Sid asked.

"Yes, that's exactly what I mean," Dawn replied.



After a long conversation, Dawn and Sid agreed to try Williams's extinction procedure. On the first day, Rod screamed and raged for 45 minutes before going to sleep! He cried even more intensely than before. But Dawn and Sid persevered. Most of us wouldn't tolerate a crying baby for even a few minutes before we returned to comfort the baby—and in doing so, we'd reinforce crying. Dawn and Sid did resist that temptation, and Rod's crying gradually decreased. By the 10th bedtime, Rod didn't even whimper (Figure 10.1). He simply smiled as Dawn and Sid left the room. They could hear him making happy sounds as he fell asleep.

A week later, Sid put Rod to bed and left the room as usual. Rod immediately began screaming and fussing. Sid gave in. He returned to the room and remained there while Rod went to sleep. Rod's crying needed no more reinforcement. After that one instance of backsliding, Dawn and Sid had to go through the whole extinction process again; the next time they put Rod to bed, he cried for 50 minutes before going to sleep. But everything was in good order by the ninth time, when this crying stopped for good. In less than 2 weeks, they had gotten rid of a problem that had been making their lives miserable. And Rod's crying never became a problem again.

Definition: PRINCIPLE

Extinction

- Stopping the positive or negative reinforcement contingency
- for a previously reinforced response
- causes the response frequency to decrease.

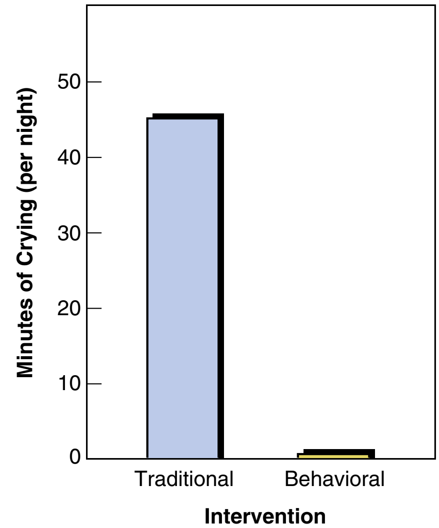


Figure 10.1 Using Extinction to Reduce an Infant's Nighttime Crying

QUESTIONS

1. Describe the traditional way parents attempt to reduce bedtime crying. What's wrong with this technique?
2. What reinforcers may maintain excessive bedtime crying?
3. Describe the use of extinction to reduce bedtime crying. Include:
   - the reinforcer withheld
   - the results
4. After a week of the extinction procedure, the infant began to cry again at night. Why?
5. And, of course, please define *extinction* (yeah, we know; this is just a little rehearsal from back in Chapter 2.)

DON'T TRY THIS AT HOME!

This classic example of extinction is certainly possible, but probably a lot harder than you'd think. Sid and Dawn are two competent behavior analysts, and they couldn't even get with the program without much effort and a few mistakes along the way. One slip-up every now and then, and all your progress may be lost down a drain of tears. So, our advice is to consider the possibility of not trying this at home unless you are a hotshot behavior analyst, and even so, you might want to test out extinction (and your own strength) with someone else's kid first. The sick social cycle often breaks us before the behavior has a chance to extinguish. In other words, the aversiveness of hearing your own sweet little child crying is so strong that it's hard for most parents not to give in and ruin their efforts at extinguishing their child's crying, though some parents do manage to wait out the kid. Even Sid and Dawn had a hard time with it.

Actually, after going over this chapter with our grad students, who've had much more experience with this than we've had, they mainly had horror stories of their attempts to try this with someone else's kid. As an RBT (Registered Behavioral Technician—high-school degree), or as a BCaBA (Board Certified assistant Behavior Analyst—bachelor's degree), or as a BCBA (Board Certified Behavior Analyst—master's degree), you may often be working with someone else's kid in their home. And there's a good chance one of the kid's problem behaviors is tantruming, and that tantruming is reinforced with attention, etc. Also, there's a good chance Mommy (occasionally Daddy) will be looking over your shoulder as you naïvely start to extinguish the tantruming. And there's a very, very good chance the parent will rush in to comfort their sweet little child, thereby reinforcing the extinction burst. So, you may want to make sure you and the parent are both ready for the kid's extinction burst. Whew!

Example of Extinction Developmental Disabilities

EXTINCTION OF ELOPEMENT[1] (G-15)

The halls of the Rosa Parks Academy rang with confusion and chaos.

"Get him!"

"He ran into the cafeteria."

Shouts echoed through the school. A teacher and two classroom aides chased a grinning boy. He was an 11-year-old, severely mentally disabled child with autism, named Josh, who rarely stayed in one place. Dr. Mae Robinson walked toward the chaos just in time to see Josh bolt into a classroom. Jaci Jacobs, Josh's teacher, and two classroom aides ran after him. Jaci stopped when she saw Mae.

"Dr. Robinson! Thank goodness, you got my message. Help!" Jaci pleaded.

"Let's sit down," Mae suggested, "and you can tell me about the problem."

Jaci saw one of the aides leading Josh back to the classroom. Though the aide was winded and sweaty, Josh appeared relaxed and content, happily munching potato chips. Jaci took a deep breath and told Mae about the problem.

The Problem

Josh had been running away from people more than 20 times an hour. This behavior had started a month ago. Jaci and her teacher's aides were baffled. They didn't know why he was running away or how to handle the problem.**

Jaci began, "At first, I thought he was running away because the tasks we were asking him to do were too hard. But he never runs away when he's in an instructional session."

Mae asked, "What usually happens after Josh runs out of the room?"

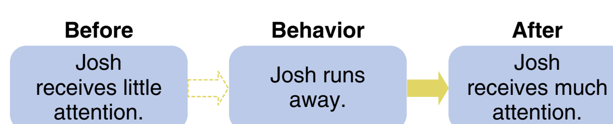
"Well, we run after him, catch him, and bring him back." Jaci said.

"It sounds as if he gets a lot of attention by running away," Mae said.

"Yeah, I guess he does," Jaci said "but he doesn't always seem to be pleased by the attention. Sometimes we even have to give him whatever food or toys he has found during these episodes, just to calm him down and get him back in the classroom."

Mae and Jaci sat and spoke for a while longer and were able to observe a few more episodes during that time. As Jaci talked and Mae took notes, Mae began to see several contingencies that could be reinforcing Josh's running away:

Josh got attention for running away.



Mae noticed that often, the aides would try to comfort Josh on the way back to the classroom. They would hold his hands, rub his back, or say things like "It's OK, Josh; we'll find something fun to do in our classroom; you don't need to run away." Of course she understood why the aides did this. It's hard not to comfort a child who seems to be under so much stress. And it's hard not to reason with a child, even when that child doesn't have the language skills to understand

** Running away, also called elopement, can be hazardous because children who run away may encounter dangerous situations (traffic, for example).

anything you're saying. But the danger is that the soothing sounds and touch might function as a reinforcer for his eloping. And if that's the case, the extra attention is just adding fuel to the flames.

Josh also got things (like the potato chips) when he ran away—things he was allowed to bring back to his classroom.

Before	Behavior	After
Josh has no chips, toys, etc.	Josh runs away.	Josh has chips, toys, etc.

Functional Analysis (F-8)

Mae did a functional analysis to find out whether attention and tangible items were reinforcing Josh's running away. She arranged a special environment so she could focus on the different contingencies separately. Using two small adjoining rooms, she set up four contingencies for running away. One room she called the "before" room, which corresponded to Josh's classroom and is shown in the before condition in the following contingency diagram. The other room she called the "after" room, which corresponded to wherever Josh ran away to, and is shown in the after condition. Then she looked at Josh's behavior in each condition (with each of the contingencies in effect).

Generic Contingency for Running Away

Before	Behavior	After
Setting and conditions in the "before" room	Running away	Setting and consequences in the "after" room

Mae was going to look at four conditions: In the first condition, Josh would get attention in the form of reprimands from the staff for running into the other room. (Even though most of us would try to avoid reprimands, they are a form of attention and can be reinforcing for some people sometimes.) In the second condition, Josh would gain access to preferred tangible items in the after room. In the third condition, Josh was ignored in both rooms. And in the fourth condition, the play condition, Josh got access to toys, food, and attention as long as he remained in the before room. Normally, one of the conditions for a functional analysis is an escape condition. This would test to see if escaping from a demand situation was what kept the problem behavior going. But Mae didn't worry about testing this contingency because Jaci had reported that Josh never ran away during instructional sessions.

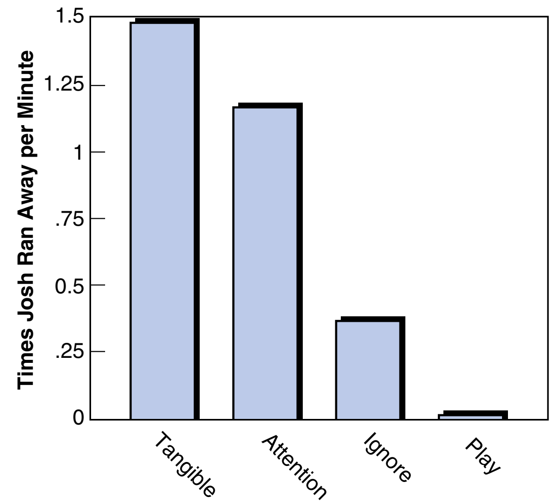


Figure 10.2 Functional Analysis of Running Away

RESULTS OF THE FUNCTIONAL ANALYSIS (F-9)

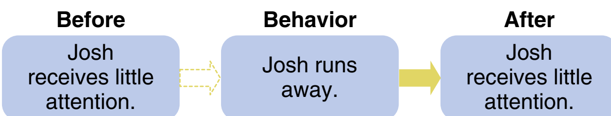
During the condition where Josh got a tangible reinforcer (such as potato chips or a toy) after running away, he ran out of the room at least once a minute even when he didn't receive attention from Jaci. Josh also ran out of the room at least once a minute when he received attention from Jaci but no tangible reinforcers after running away (Figure 10.2).

Mae studied the data carefully. "Thank goodness for functional analysis!" she thought. "Now I can easily see that Josh's running away was reinforced by both attention and tangible reinforcers. I'll use two extinction procedures to decrease Josh's running away."***

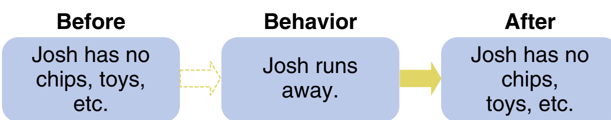
*** Functional analyses have gained much recognition over the years. A well-planned functional analysis can produce much information about a problem behavior; however, we must always make sure the benefits are worth the costs. Functional analyses can take time and cost money. Therefore, in our opinion, it often may be more practical to take an educated guess at the contingencies maintaining a problem behavior and develop an intervention based on that guess. For instance, in the present example, Mae guessed that attention and tangible reinforcers were maintaining Josh's running away. Had she used these educated guesses to design an intervention, it would have been similar to the one produced by the functional analysis, and the problem would have been solved more quickly. Even if Josh hadn't stopped running away, the trial-and-error intervention would have provided information about the problem behavior. Mae could have made a new educated guess based on the information from the first intervention. But for purposes of generating a publishable and

INTERVENTION

First, Mae told Jaci and the classroom aides to ignore Josh's running away (in other words, not to reinforce his running away with attention).



Second, she told them not to allow Josh to keep any tangible reinforcers he grabbed when he ran away.



In other words, they were extinguishing his running away, at least with regard to the attention and tangible reinforcers; that's why the before and after conditions in each of the preceding two diagrams are the same.

Also, because Josh hadn't run away at all when playing with Jaci, Mae guessed that the attention and praise during toy play reinforced playing in the room. So, Mae asked Jaci to give Josh more positive attention when he was in the classroom, regardless of what he was doing.

RESULTS

It worked. The number of times Josh ran away dropped from more than once per minute to essentially none (Figure 10.3). The classroom staff continued to give Josh noncontingent attention in the classroom and no attention when he left the classroom. Now Josh hardly ever ran away. However, these results were for the training rooms. But when Jaci and her aides used the same procedures in the real, upstairs classroom, again Josh hardly ever ran away. In other words, extinction not only worked in the training room but also worked in the real-world classroom.

In addition to running away from his classroom, Josh had also been running away from his home. So Mae did a similar functional analysis there and then helped Josh's mother implement a similar set of procedures that essentially eliminated his running away from there as well.

clear demonstration of these underlying behavioral processes, the exact, experimental, scientific approach of the functional analysis is more convincing.

Josh's running away had been a big problem, not only because of the potential physical danger, but also because it was driving the school staff and his mother crazy, because it took teacher time away from the other children and because it caused Josh himself to waste so much time that he lost many chances for learning valuable skills in the classroom. Therefore, solving this problem with functional analysis, extinction, and other procedures was a big deal in everybody's life.

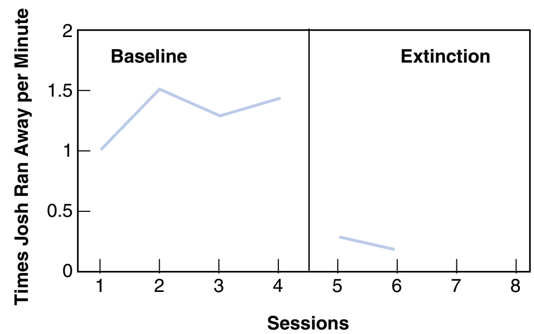


Figure 10.3 Extinction of Josh's Running Away

QUESTION

1. Describe a functional analysis that led to an intervention to stop an autistic child's running away.

Principle

EXTINCTION BURSTS AND SPONTANEOUS RECOVERY (H-5)

The extinction process may involve ***extinction bursts***—initial increases in the response frequency, magnitude, or intensity, especially if that response has an "emotional" or aggressive component. For instance, when Dawn and Sid stopped paying attention to Rod's crying, that crying increased at first before it began to extinguish. Such initial increases often seem emotional—temper tantrums resulting from the failure of the previous temper tantrum to produce reinforcers.

Such an extinction burst raises an interesting problem. Suppose your little brother interrupts frequently when you are talking with other adults. And suppose you try to extinguish his interruptions by no longer paying attention to him. The first time you use this procedure, you might get an emotional extinction burst—your little brother might be even more disruptive than usual. He might talk more loudly, and he might even cling to your arm, wave his hand in front of your face, or stand between you and the other adults. But if you can put up with such an aversive condition, his disruptions will extinguish. Have faith!

Definition: PRINCIPLE

Spontaneous recovery

- A temporary recovery of the extinguished behavior.

But aside from this brief emotional extinction burst, extinction has another interesting feature. Rod stopped crying after 45 minutes of extinction, during the first bedtime. But though they had won the battle, Dawn and Sid knew they had not yet won the war. They had more battles ahead. And sure enough, the third time they put him to bed, Rod's crying recovered spontaneously. Rod's crying recovered, though his parents had not reinforced it. He cried for only 9 minutes this time, though. And during the fourth bedtime, his crying **spontaneously recovered** for an initial 5 minutes of crying.

Note that spontaneous recovery occurs only during the first *part* of each of the first few sessions that follow the first extinction session. Also, note that spontaneous recovery can't occur during the first session of extinction. Why not? Because there's nothing to recover from. The frequency of responding during the first part of the first session of extinction is as high as the responding during the reinforcement sessions. But then, during that first session, the frequency of responding gradually reduces. However, during the first part of the second extinction session, the response frequency recovers somewhat, so that it is much higher than it was during the end of the previous extinction session. That's spontaneous recovery.

Extinction bursts and spontaneous recovery are two reasons behavior analysts are often reluctant to recommend extinction as an intervention for parents or teachers dealing with serious behavior problems. It's often too difficult to ignore the behavior of interest, especially during an extinction burst. And it's likely that they'll eventually have to give in and reinforce a potentially more intense version of that problem behavior.

QUESTIONS

1. What's liable to happen at the beginning of your first extinction session?
2. *Spontaneous recovery*—state the principle and give an example.

Example of Extinction Behavioral Special Education

ERIC'S TANTRUMS—PART II[2]

Because of Eric's classroom temper tantrums (see Chapter 6), the principal of West James Elementary School had asked Mae Robinson to help Eric get his tantrums under control. His frequent tantruming disrupted the whole school and interfered with his learning anything worthwhile. Mae didn't buy into the popular belief that Eric's tantrums resulted from his inner anguish. She knew that crying might occur initially without outside reinforcement, but also attention could reinforce his crying and cause his crying to escalate into tantruming.

Mae had read a study by a schoolteacher, Elaine Zimmerman, and her husband, Dr. Joseph Zimmerman. They had used an extinction procedure to get rid of a child's temper tantrums in the classroom. She thought extinction might also work with Eric. So she explained her plan to Sue, who was in charge of Eric's classroom.

The next time Eric tantrumed, Sue and the teacher's aide sat him back down at his desk. Then Sue said, "When you finish crying, we can start working." She then went about her business, ignoring Eric. He cried for eight more minutes and then said he was ready to work. Sue immediately went to his desk and helped him with his English exercises. He cooperated for the rest of that class; and after several weeks of extinction, Eric had completely stopped tantruming in Sue's class.

QUESTION

1. Describe the use of the extinction to reduce temper tantrums. Include:
   - the client
   - the reinforcer withheld
   - the results

Compare and Contrast

EXTINCTION FOLLOWING REINFORCEMENT VS. NEGATIVE PUNISHMENT (RESPONSE COST AND TIME-OUT)

Sid and Dawn visited Sid's sister and her family last summer. Sid's sister was worried because her two children had the foulest mouths of any children in their school district. They used words that would have made a sailor blush. So Sid offered his professional services.

The next morning at breakfast, the little boy said, “Pass the #$%! lox and a bagel, please.”

Sid intervened with the lightning-like speed of a true professional. “Young man, you are in time-out. Go sit in the living room for 2 minutes. I’ll tell you when the time’s up.”

The whole family sat in shocked silence as the little boy trudged off to fulfill his penalty. “And now, young lady,” Sid said, addressing his niece, “did you learn anything from this?”

“You can bet your #%@&! I don’t want any of those #$%! lox and bagels!” she replied.

Sid was using a punishment procedure, more specifically a negative punishment (penalty) procedure, and even more specifically a time-out procedure.

Time-Out

Before	Behavior	After
Nephew is at the breakfast table.	Nephew swears.	Nephew is not at breakfast table.

The goal was to reduce the swearing. How might he have used extinction to reduce the swearing? Instead of taking away an existing reinforcer (negative punishment), he would simply have withheld the relevant reinforcer from his nephew. He would have ignored the foul-mouthed request for the lox and bagel.

Extinction

Before	Behavior	After
Nephew has no lox and bagel.	Nephew swears.	Nephew has no lox and bagel.

Both extinction and negative punishment involve a decrease in the frequency of the response because of the lack of the reinforcer. But negative punishment involves the contingent *removal* of reinforcers. And extinction involves stopping the reinforcement contingency. In extinction, you don’t remove something; you just stop presenting it.

In the extinction procedure, the reinforcer you stop giving is the one that had maintained the behavior. With negative punishment, the reinforcer you remove differs from the one reinforcing the behavior.

This might be clearer if Sid had used a response-cost procedure. For example, he might have said, “That cost you your dessert.” The dessert is not the reinforcer maintaining the swearing.[3]

Response Cost
Punishment by the Withholding of a Reinforcer

Before	Behavior	After
Nephew will get dessert.	Nephew swears.	Nephew won’t get dessert.

But we may have already pushed the fable of the lox and bagels further than we should have, because the reinforcer for the swearing is not too clear in that example. It might be some sort of automatic reinforcer (Do you ever swear to yourself?), it might have been a social reinforcer (the reaction of the adults or other children), or it might have been the receipt of the bagel and lox. So let’s modify it slightly and assume the shocked reaction of the adults is a major reinforcer for the nephew’s swearing (that’s true in my case).

And now, as Uncle Sid sits reading the *New York Times*, he hears his niece say, “*Sesame Street* is the most educational #&$! TV show I’ve ever seen.” Now, Uncle Sid could ignore the remark—he could ignore the swearing. That would be extinction. He could say, “That cost you a quarter from your piggy bank.” That would have been response cost. Or he could say, “Turn the TV off for 2 minutes.” That would have been time-out.

In extinction, the frequency of her swearing would have no effect on the availability of the reinforcer, Uncle Sid’s attention. But with negative punishment, the niece’s swearing would have the immediate effect of removing a reinforcer, either the quarter or the TV. Her behavior controls the removal of the reinforcer.

Another difference between extinction and negative punishment contingencies lies in the process of the behavior change. In extinction, the frequency of the response may initially increase and then decrease slowly. In negative punishment procedures, the frequency of the response often decreases immediately and rapidly.

To read the following table, select one of the cells from the left column, one from the top row, and the corresponding cell—for example, *“extinction,” “procedure,”* and “*stop* *giving the reinforcer*." Then it reads like this: *The* ***extinction procedure*** *consists of* ***no longer giving the reinforcer***.

Differences Between Extinction Following Reinforcement, Response Cost, and Time-Out

	Procedure	Process or Results
Extinction	Stop giving the reinforcer maintaining the behavior	Response rate decreases, often slowly.
Response Cost	Contingent loss of a reinforcer currently possessed	Response rate decreases, often rapidly.
Time-Out	Contingent removal of access to a reinforcer	Response rate decreases, often rapidly.

QUESTION

1. Compare and contrast extinction with response cost and with time-out.
   - Show the similarities and the differences.
   - Use examples to make your points.
   - Construct and fill in the relevant compare and contrast table.

Example of Extinction Behavioral Special Education

SELF-STIMULATION[4]

Jimmy, the Child With Autism[5]—Part VI

"Jimmy, put your toy on the shelf," Sue repeated for the third time. But Jimmy was too busy flapping his hands. He would continuously flap his hands during much of the training sessions. This high frequency of self-stimulation interfered with Sue's helping Jimmy.

Self-stimulation dominates the lives of many unfortunate children, as Jimmy's hand flapping dominated his. This self-stimulation prevents them from learning much else. High rates of inappropriate behaviors like self-stimulation, echolalia, tantruming, and aggression cause psychologists to classify these children as having intellectual or mental disabilities, developmental delays, or autism.

Jimmy's hand flapping was independent of Sue's reinforcers. Mae had read a *JABA* (*Journal of Applied Behavior Analysis*) article by Dr. Rincover and his colleagues; these experts in the treatment of self-stimulation thought the automatic, built-in reinforcement contingencies of sensory stimulation might be maintaining such hand flapping. We call this type of stimulation *proprioception*—stimulation arising from muscle movement.

Dysfunctional Natural Contingency

Before	Behavior	After
Jimmy has no sensory stimulation.	Jimmy flaps his hands.	Jimmy has sensory stimulation.

With more imagination and creativity than we have any right to expect, Rincover and colleagues designed the following extinction procedure: They taped small vibrators to the back of the hands of a child with autistic behavior. The vibrator generated a low-intensity, high-frequency pulsation. Such a device didn't physically restrict hand flapping. Instead, the researchers hoped the vibration would mask the proprioceptive stimulus and thereby remove its reinforcing value. In other words, the child could flap his hands without feeling them flap. And this is the procedure Sue tried with Jimmy.

Performance-Management Contingency

Before	Behavior	After
Jimmy has no sensory stimulation.	Jimmy flaps his hands.	Jimmy has no sensory stimulation.

Their extinction procedure worked for Rincover's child, and it also worked for Jimmy. After they strapped on the vibrator, Jimmy's hand flapping decreased to zero (Figure 10.4).

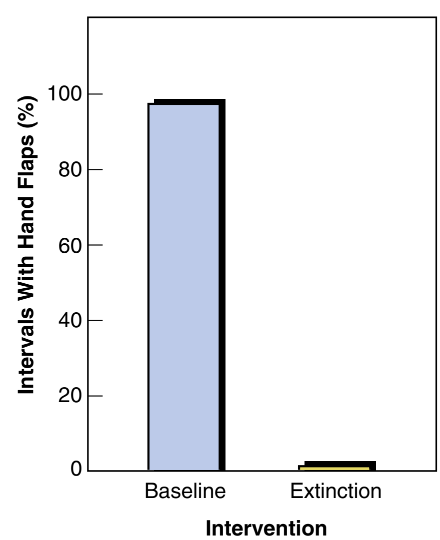


Figure 10.4 Sensory Extinction of Self-Stimulation

Rincover and his colleagues designed equally successful extinction procedures for other children who had little or no intelligible speech, Reggie and Karen among them. Reggie twirled objects such as plates on a hard table and then listened as they spun. Auditory stimulation seemed to reinforce his plate spinning. So they carpeted the table and prevented the sound. This procedure completely extinguished his plate spinning.

Karen picked feathers, lint, or a small string from her clothes and threw it in the air, keeping it afloat by waving her hands vigorously below it. Perhaps the visual reinforcers of the sight of the floating objects were maintaining this strange behavior. They turned the overhead lights off because they found this made it impossible for her to see the floating material, though the room was well lit from the sunlight. This extinction procedure completely got rid of Karen's self-stimulation.

QUESTION

1. Describe the use of extinction to reduce hand-flapping self-stimulation.

- Diagram the dysfunctional natural contingency.
- Diagram the performance-management contingency.

Example of Extinction of Escape Behavioral Special Education

AGGRESSION[6]

"Bob, sit in your chair. I said, sit down. . . . Don't you hear me? *Sit down*!" Fourteen-year-old Bob jumped at the teacher, hitting him, scratching him, biting him, and kicking him—drawing blood and bruising the teacher's arms and legs. After his assault, Bob sat on the floor in his favorite corner of the classroom for mentally disabled children. For the last 9 years, Bob had attacked adults and sometimes children. Nothing helped. The medical doctors had failed with their heavy-duty drugs like the major tranquilizers Thorazine, Stelazine, and Mellaril. Nothing cooled out Bob's aggression. So behavior analyst Dr. Edward Carr and his associates came on the scene.

We know behavior results from reinforcement contingencies. But what reinforced Bob's aggressive attacks? The behavior analysts tried to answer that question first. They guessed that stopping the teacher's instructions reinforced Bob's aggression. In other words, reinforcement by the removal of an aversive condition—negative reinforcement (escape).

Inappropriate Negative Reinforcement Contingency

Before	Behavior	After
Bob receives instructions.	Bob aggresses.	Bob receives no more instructions.

Now they needed to test their guess—to find out if Bob's aggression really was an escape response from adult instructions. They would use extinction of the escape response; they would no longer allow Bob to escape instructions by aggressing.

Performance-Management Extinction

Before	Behavior	After
Bob receives instructions.	Bob aggresses.	Bob receives instructions.

A dangerous task! The behavior analyst working directly with Bob needed to protect himself. So he wore a thick corduroy coat and rubber gloves during the 5-minute observation sessions. He sat facing Bob's chair; the other two behavior analysts sat safely on the opposite side of the room, recording the frequency of Bob's aggression.

They required that Bob sit in the chair. Whenever he raised himself 3 inches off the chair, the behavior analyst facing Bob would say, "Sit down," and would physically prompt this response, if needed. That was enough to cause Bob to kick, hit, bite, and scratch more than 120 times in each 5-minute session. But in conditions where the behavior analyst made no requests, Bob did not aggress at all; instead, he spontaneously sat on the floor in one corner of the room. It looked more and more as if Bob's aggression was an escape response from instructions.

The behavior analysts used the extinction procedure to get rid of Bob's aggression so he could function well in a regular class. The behavior analysts working directly with Bob still wore protective clothing during each 1-hour extinction session.

"Sit down," the behavior analyst said. (*These instructions were aversive for Bob*.) And Bob, as usual, hit, kicked, bit, and scratched. (*He made his escape response*.) "Sit down, sit down, sit down," the behavior analyst kept repeating while Bob aggressed. (*They were no longer reinforcing the escape response; they were no longer stopping the instructions; they were extinguishing the escape response*.) He aggressed over 500 times in each of the first 3 sessions; but after 5 grueling hours of this procedure, Bob emitted only one or two aggressive acts per session. (*His aggressive behavior had extinguished*.)

Then the behavior analysts slowly made the intervention conditions more like a regular class. They removed their protective coat first, then the gloves. They also reinforced compliance to instructions; eventually, they would say, “Do this.” Then, for example, a behavior analyst would clap his hands, and they would praise Bob’s compliance or prompt the correct response when he didn’t comply. By the end of this intervention, Bob responded correctly to instructions 97% of the time, and his aggression dropped to nearly zero. This was extinction of a response that escape from an aversive condition had reinforced.

QUESTIONS

1. As always, when you see contingency diagrams in the text, be able to reproduce and explain them—in this case, it’s the inappropriate contingency and the performance-management contingency.
2. How did the behavior analysts make the conditions of their intervention more similar to the conditions of the regular class?

Example of Two Types of Extinction Behavioral Medicine

A MENTALLY DISABLED CHILD’S VOMITING[7]

Nine-year-old Laura could not speak. Physicians diagnosed her as “suffering from a mental disability, cerebral palsy, aphasia, hyperirritability, and brain damage.” She entered the Rainier School, an institution for the mentally disabled in the state of Washington. When Laura arrived, she had a strange tendency to vomit frequently, but within a few weeks, her vomiting decreased to once or twice a month. Soon everybody forgot the vomiting. After 6 months at the school, Laura started a class that met every day. A month later, she began vomiting occasionally in class, and within 3 months, she vomited nearly every day. Laura became a markswoman with her vomiting. Her favorite targets included the teacher’s desk and the table where other members of the class sat.

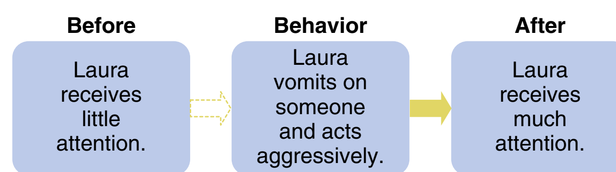
Each time she vomited, Laura also screamed, tore her clothes, and destroyed nearly everything she could. She often vomited on her dress; whenever this happened, the teacher took her back to the residence hall. Physicians used drug therapy, but it didn’t help. After 3 months, the teacher permanently excused Laura from class because of her vomiting.

Two months later, a brave teacher volunteered to take Laura into her class with the idea that Dr. Montrose Wolf and his colleagues would help her, because a physician said medical factors hadn’t caused Laura’s vomiting.

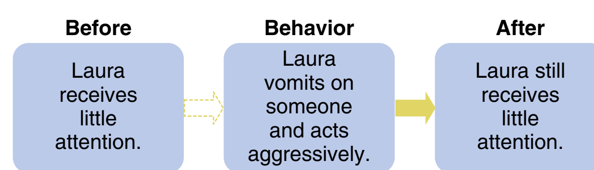
People often assume that reinforcement cannot control vomiting, but Dr. Wolf decided to see if it could. He guessed that the consequences of vomiting reinforced Laura’s vomiting. As you can well imagine, her vomiting attracted attention even in an institution for the mentally disabled, where bizarre behavior is the rule.

Dr. Wolf and his colleagues decided to stop the special attention everybody paid her and to stop taking her from the classroom, because that might be reinforcing the vomiting. The only attention following her vomiting was the removal of her mess as soon as possible.

Dysfunctional Positive Reinforcement Contingency



Performance-Management Extinction of Attention



At the beginning of the extinction procedure, Laura vomited many times in each daily, half-hour class. The frequency of vomiting was so great that, in one class, she vomited 21 times (behavior may at first increase in frequency during extinction, especially aggressive behavior). The teacher who put up with this to help Laura deserved the humanitarian-of-the-year award. By the end of 30 days, the frequency of vomiting had gradually decreased to zero. Surely, that teacher felt relieved when the vomiting had finally extinguished.

Notice that Dr. Wolf’s intervention involved the combination of two extinction procedures. One extinction procedure involved breaking a reinforcement contingency. Attention produced by Laura's vomiting might have reinforced such undesirable behavior. So, in extinction, Laura's vomiting no longer resulted in the presentation of the reinforcer—attention.

The other extinction procedure involved breaking a negative reinforcement contingency. Being in class might have been an aversive condition for Laura. And vomiting ended this aversive condition when the staff removed her from the class—a negative reinforcement contingency.

Dysfunctional Negative Reinforcement Contingency

Before	Behavior	After
Laura is in a class she finds aversive.	Laura vomits on someone and acts aggressively.	Laura is not in a class she finds aversive.

But during extinction, vomiting no longer resulted in removal from class. In the next section, we'll look more at extinction following negative reinforcement.

Performance-Management Extinction of Negative Reinforcement

Before	Behavior	After
Laura is in a class she finds aversive.	Laura vomits on someone and acts aggressively.	Laura is still in a class she finds aversive.

QUESTIONS

1. Diagram a dysfunctional reinforcement contingency and a dysfunctional negative reinforcement contingency that might maintain vomiting.
2. Also diagram the relevant performance-management contingencies.

Example of Recovery From Punishment Behavioral Clinical Psychology

SELF-INJURING[8]

Five-year-old Judy put her hand in her mouth beyond her first knuckles. She did this so much that she had damaged her hands and face, producing sores, calluses, and displaced teeth. This multiply disabled child had been in the hospital for 3 1/2 years, confined to a wheelchair she could not control. She had impaired vision and hearing and major seizures.

Several psychologists had tried different interventions to get rid of Judy's self-injurious behavior—her putting her hand in her mouth—but all had failed. There seemed no hope for Judy. Then Mike Dorsey (with the help of Dr. Brian Iwata and some fellow students from Western Michigan University) agreed to work with her. Mike was doing this as part of the research for his master's thesis.

Mike wasn't sure what was reinforcing Judy's self-injurious behavior, so he couldn't extinguish that behavior by no longer giving the maintaining reinforcer. Instead, he tried to decrease the frequency by using a positive punishment procedure. Because he wanted to use as mild an aversive stimulus as possible, he used a fine mist of water sprayed in Judy's face. Now if he had asked us, we'd have told him he was a dreamer. We'd have thought that no way could such a mild irritant effectively suppress such a well-established response. But he didn't ask us.

Performance-Management Positive Punishment

Before	Behavior	After
Judy receives no mist spray.	Judy puts her hand in her mouth.	Judy receives mist spray.

Before their intervention, Judy had her hand in her mouth 80% of the time. But the mild mist punishment was so effective that within the first 20-minute session, she decreased this long-standing self-injurious behavior to only 20% of the time. And after 10 sessions she had almost completely stopped putting her hand in her mouth. It was a good thing Mike had not asked us.

To show that the positive punishment contingency had caused Judy's decrease in self-injury, Mike and his colleagues stopped the punishment contingency for a few sessions.

Performance-Management Recovery from Positive Punishment

Before	Behavior	After
Judy receives no mist spray.	Judy puts her hand in her mouth.	Judy receives no mist spray.

And during the recovery phase, Judy had her hand in her mouth 90% of the time.[9] In other words, Judy's self-injurious behavior recovered after the positive punishment contingency was stopped. When they started the punishment contingency again, her self-injury immediately dropped to nearly 0% (Figure 10.5).

Incidentally, this mist punishment didn't work only with Judy. As part of his master's thesis, Mike used it with six other clients with self-injurious behaviors, such as hand biting, skin tearing, and head banging. Always, this mild punishment was fast and effective.

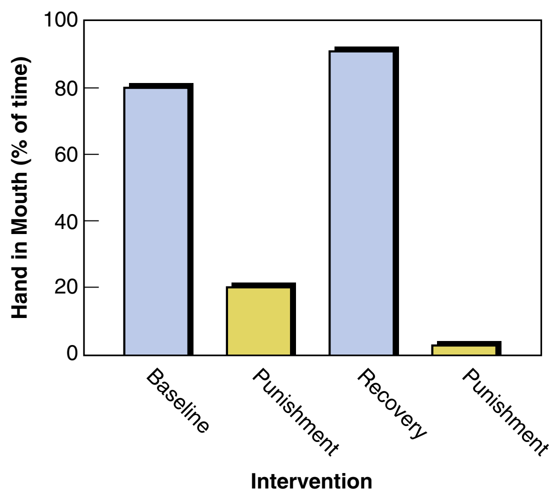


Figure 10.5 Using Mild Mist to Punish a Multiple-Disabled Child's Self-Injurious Behavior

QUESTIONS

1. What was the positive punishment contingency used to get rid of self-injury?
2. Describe the use of punishment to reduce self-injury. Include:
   - the client
   - the behavior
   - the aversive stimulus
   - the results
3. What happened when the punishment contingency was stopped?
4. What happened when the punishment contingency was resumed?

Principle

RECOVERY FROM PUNISHMENT

We have seen that the frequency of the response decreases when we stop positive and negative reinforcement contingencies. In other words, extinction takes place. But we get the opposite results when we stop positive or negative punishment contingencies. Then the frequency of the behavior increases. That's why we looked at Judy's case. The behavior analysts punished self-injury with the immediate presentation of mist. But when they stopped this punishment contingency and self-injury no longer produced the mildly aversive mist, the frequency of self-injury increased. We call this **recovery from punishment**—the increase in response frequency resulting from the stopping of positive or negative punishment contingencies.

Definition: PRINCIPLE

Recovery from punishment

- Stopping the positive or negative punishment contingency
- for a previously punished response
- causes the response frequency to increase
- to its frequency before the positive or negative punishment contingency.

Here's another example. Suppose you often talk with your friends in the library, in spite of the "be quiet" signs. Then a new librarian intervenes with a positive punishment procedure. Every time you talk out loud, she rushes to your table to ask you to be quiet. She does so with an aversive, condescending style. She makes you feel as if you're a naughty grade-school student rather than a sophisticated college student. Of course, your frequency of talking decreases. But after a few weeks, Church Lady is canned. And her replacement no longer punishes your boisterousness. So you, again, become your inconsiderate loudmouth self. Thank heavens for the recovery process!

You might think that if stopping punishment contingencies results in the recovery of previous undesirable behavior, then punishment procedures are not effective in the long run. But it's not only with punishment that we get a return to the previous behavior after stopping a behavioral contingency. The frequency of behavior also decreases when we stop reinforcement contingencies; in other words, extinction occurs. Of course, behavior recovers when you stop a punishment contingency if a reinforcement contingency is still there to maintain that behavior.

QUESTIONS

1. *Recovery from punishment*—state the principle.
2. After you stop a punishment contingency, the original frequency of behavior recovers. Is this unique to punishment? If not, then what's another example where the original frequency of behavior returns after the contingency is stopped?

Example of Recovery From a Negative Punishment Contingency Behavioral Clinical Psychology

SELF-STIMULATION AND DESTRUCTIVE BEHAVIOR[10]

Lynn Larson, a 6-year-old with autism and an IQ of 20, was referred to the hospital because of extreme self-stimulation and extreme destructive behavior.

Two behavior analysts sat behind a one-way mirror, watching Lynn play. Every 10 seconds they marked their recording sheets. In the experimental room, another behavior analyst sat on a sofa in front of Lynn. A box containing a variety of toys was on the floor. Often Lynn stopped her playing and self-stimulated by walking on her toes, arching her body, flapping her hands, or waving toys in front of her eyes. She also threw the toys, scraped the wall and a table with a toy car, and knocked over a chair. In the baseline sessions, Lynn self-stimulated or destroyed property during 86% of the 10-second recording intervals.

Later, Marjorie Charlop and her colleagues started a time-out contingency. Whenever Lynn acted inappropriately, the behavior analyst in the room faced her toward the wall for 5 seconds. We can't imagine that a mere 5-second time-out could reduce Lynn's self-stimulation and destructive behavior. But it did. In the four sessions of this time-out procedure, Lynn acted inappropriately during only 27% of the intervals.

Then, to show that the time-out caused the decrease of problem behavior, the behavior analysts stopped the time-out contingency. And Lynn's problem behaviors recovered to occupy 55% of the intervals (Figure 10.6).

This recovery procedure showed the importance of time-out. (After that, the behavior analysts started another punishment contingency to further reduce Lynn's self-stimulation and destructive behavior.)

Analysis

Lynn's problem behaviors decreased when the behavior analysts used the time-out procedure. This is what we expect from contingent removal of the opportunity to play; negative punishment contingencies cause the response frequency to decrease. Stopping the time-out contingency resulted in recovery; the frequency of self-stimulation and disruptive behavior increased nearly to the frequency before the negative punishment contingency. With more time, the frequency probably would have returned all the way to baseline.

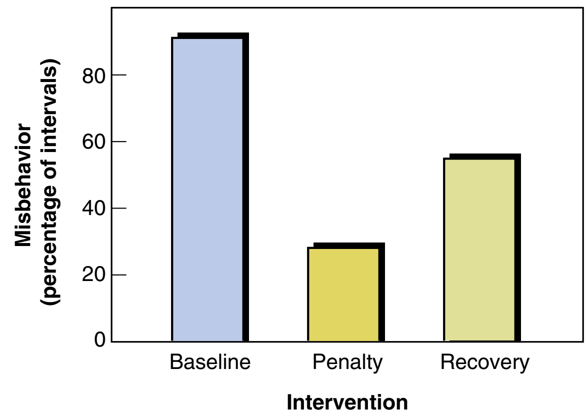


Figure 10.6 Using Time-Out to Reduce Self-Stimulation and Destruction

We should get a similar recovery after stopping a response-cost contingency. Suppose a teacher had reduced disruptions with a response-cost procedure. Let's say he set up what we call a *token economy*, where the students could use their tokens, as if they were money, to buy other reinforcers at the end of the day. He gave tokens to each child at the beginning of the class and removed one immediately after a child was disruptive. If the teacher stopped using the response-cost contingency, the frequency of these response-cost suppressed disruptions probably would recover to their original high baseline frequency. So we expect recovery to baseline after stopping either type of negative punishment contingency, either the time-out contingency or the response-cost contingency.

QUESTIONS

1. Describe the use of time-out to reduce self-stimulation and destructive behavior. Specify:
   - the client
   - the reinforcer involved in the time-out
   - the results
   - what happened when that time-out contingency was stopped
2. Give an example of recovery from a response-cost contingency.

Example of Extinction
Behavioral Special Education

JIMMY, THE CHILD WITH AUTISM[11]—PART VII

In Chapter 9, we saw Kate and Amy using negative punishment to reduce Jimmy's hand flapping. In this chapter, Kate combats a different problem, this time using extinction.

Extinction is a powerful tool, but it can also be hard to implement properly. For extinction to work you need to be consistent. But if you cave in and allow the undesirable behavior to be reinforced only once in a while (intermittently), it can become even more resistant to extinction. And often the people who try to use extinction to get rid of undesirable behaviors aren't prepared for the extinction burst and tantrums. But if you can handle it, and if you can be consistent and control much of the environment, then extinction is a great alternative to punishment.

"Well, Mrs. Lewis, we had another great session today!" Kate said.

Having just finished calculating the last of the day's data points, Kate walked into the Lewises' kitchen. She was looking for Amy Lewis, who she found attempting to balance her checkbook. Jimmy was playing on the floor next to his mother.

"I'm glad to hear that, Kate. It's so nice to . . . I'm sorry, Kate, can you hold on a second?" an exasperated Amy replied.

Amy turned away from Kate and focused on Jimmy, who had stood up and was now tugging on her shirt and beginning to scream. Her quick soothing words didn't calm Jimmy down; so, as she usually did, she rummaged in her pocket and pulled out a mini-Snickers bar. As she started unwrapping it, Jimmy began to wind down, and once she handed it to him, the only sound he made was a satisfied smack of the lips as the candy bar disappeared.

"Sorry, Kate, what was that?" she said.

"I said that Jimmy and I had another great session today, Mrs. Lewis. And I just thought of something else. Do you remember when you told me you wanted all the advice I could give you about behavior analysis?"

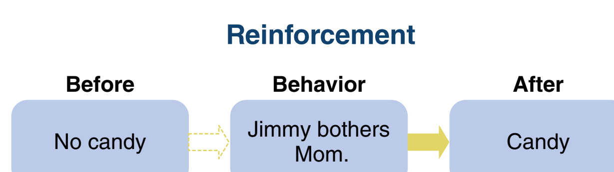
"Of course I remember," Amy said. "After reading *Let Me Hear Your Voice*,[12] I'm sure that behavior analysis can really help us with Jimmy. In fact, I've been talking with Jack about maybe taking a few night classes in behavior analysis over at Big State University."

"That's great! I'm glad you are so enthused," Kate said, "And I have another piece of behavior-analytic advice to pass along. A few weeks ago, we talked about positive reinforcers, such as the reinforcers that Jimmy gets from flapping his hands in front of his face. Well, I have a feeling that those Snickers bars you keep around the house are also powerful reinforcers for Jimmy. And I think I just witnessed a contingency that might be causing you a bit of stress."

Then Kate went on to describe how the events she had just observed were a positive reinforcement contingency. Every time Jimmy screamed and yanked on his mother's clothes while she was talking to other adults, Amy would give him a Snickers bar to try to quiet him down. And he did quiet down, at least long enough to consume the Snickers. But a few minutes later he would be back, yanking and screaming. Kate had seen this several times, and it seemed to follow the same pattern.

"I didn't even think about the possibility of reinforcing Jimmy's bad behavior," Amy said. "I guess I've just been trying to keep him quiet so I could finish my conversations."

"Don't feel too guilty," Kate said. "These types of cycles (see Sick Social Cycles; Chapter 7) can arise very easily and can be tough to get rid of."



Positive Reinforcement

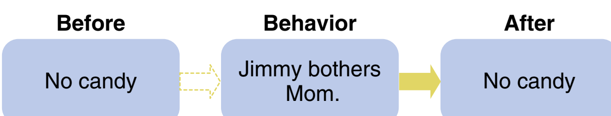
"Luckily, we can control the source of reinforcement here, because you are the source. All we have to do is change your behavior, and his should change too. It's not going to be the easiest thing you've ever done, but if you do it well, it will definitely be worth it."

Kate explained the new plan to Amy. It was deceptively simple. She just needed to ignore Jimmy's bad behavior and make sure it never got him any candy like it used to. "Right now, that bad behavior gets Jimmy something good," Kate said. "It looks like straightforward positive reinforcement."

Extinction of Positive Reinforcement

If nothing is changing from the before to the after condition, then there's no reason for the behavior to continue. Humans, like any other living creature, tend not to waste energy on unfruitful efforts. So as long as Amy doesn't give in and instead consistently ignores the bad behavior, it should go away.

Extinction of Reinforcement



Kate did warn Amy about the common problems when using extinction. Amy would need to be careful not to occasionally give in and provide the treats after bad behavior. If she did, all progress might be lost. And she had to be prepared for Jimmy to get louder and more aggressive when the old behavior wasn't working. But with support from Kate and Jack, the team was confident they could get rid of Jimmy's pestering without resorting to punishment. (In future chapters, we'll see some more complex ways to use reinforcement to reduce undesirable behavior.)

QUESTION

1. Please give an example of extinction of disruptive behavior in the home.

In the Skinner Box
Experimental Analysis of Behavior

EXTINCTION VS. SATIATION

Once again, it's time to glance at Rudolph the Rat inside the Skinner box. The positive reinforcement contingency is in place; every time Rudolph presses the lever, you give him a drop of water, but he hardly ever presses the lever. Extinction? No, maybe satiation. Maybe someone left the water bottle attached to Rudolph's home cage. He was drinking water all day, so he's no longer "thirsty"; he's satiated. So water's no longer an effective reinforcer for Rudolph, not until he's gone without water for a while. Extinction and satiation aren't the same thing: Extinction occurs when the response will no longer produce the reinforcing outcome (the water), and satiation occurs when the previously reinforcing outcome has been so readily available that it is no longer a reinforcer. Both will cause a decrease in responding but for different reasons. However, don't worry; if someone removes the water bottle for a while before you return to the lab, Rudolph will be sufficiently water deprived that water will once again be a reinforcer. But just as extinction and satiation aren't the same thing, spontaneous recovery and deprivation aren't the same thing either. (You'll read more about deprivation and satiation in Chapter 13.)

QUESTION

1. Please give examples showing the difference between extinction and satiation.

In the Skinner Box
Experimental Analysis of Behavior

EXTINCTION AND RECOVERY

Extinction After Reinforcement

Now let's make sure you've nailed the concept of extinction. This time, you're in charge. You walk into the animal colony. Go to the rack with the rat cages. Open the one with your name on it—cage #27. You reach in and pick up your buddy, Rudolph. Yes, Rudolph has a red nose—would you believe pink? And white fur. You place him on your left arm and pet him as you go to the lab. You open the door of the Skinner box and place Rudolph inside.

You're going to show extinction following positive reinforcement. How do you do it?

You've already reinforced the bar-press response with water reinforcers. So you let Rudolph get clicking with a few reinforced responses, and then you take your hand away from your end of the water dipper. Sit back, put your feet on the table, pick up your stopwatch, pen, and notepad, and watch the *process* of extinction unfold. By doing nothing, you've set up the extinction *procedure*. At first, Rudolph presses the bar furiously for a few minutes. (Remember that burst of responses you often get at the beginning of extinction?) Rudolph responds more and more slowly, and before the hour session is over, he has curled up in the corner for a snooze.

The next day, you put him in the Skinner box again and sit back to watch and record; you don't reinforce nothin'. But Rudolph starts responding again anyway, even without the reinforcers (Figure 10.7). However, the bar pressing soon tapers off. (*Spontaneous recovery* is short-lived, and it gets shorter with each session until it stops altogether.)

Extinction After Negative Reinforcement

This one's tough, both conceptually and physically—physically because it involves electric shock. So let's look into the

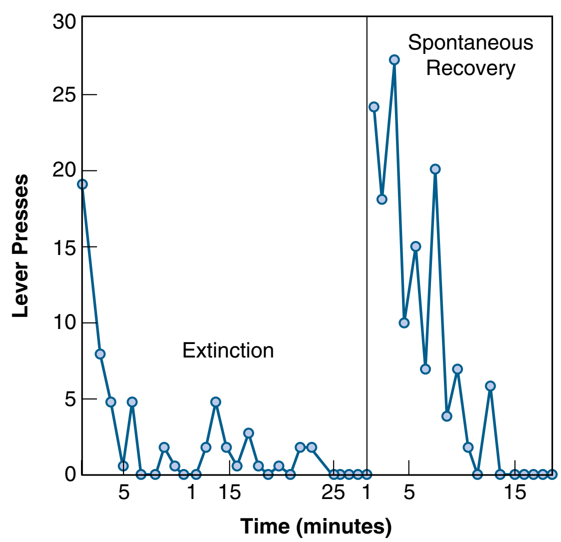


Figure 10.7 Extinction and Spontaneous Recovery of a Rat's Lever Presses in an Introductory Psychology Lab

Skinner box of a professional experimental analyst this time. You see that the rat is pressing the bar every 20 seconds. You also see that, between responses, it stands with its paws just a fraction of an inch from the bar. You know that every 20 seconds a mild electric shock turns on through the steel rods in the floor and stays on until the rat presses the bar, which it does in a split-second. Termination of the shock negatively reinforces the bar press.

Now comes the tricky part: extinction following negative reinforcement. Your job is to tell the experimenter how to do it. No problem, right? Just turn the shock off and watch the bar press extinguish. Gotcha! Oh, if life were so simple and so gentle. No, turning the shock off and then expecting this rat to press the bar would be like filling Rudolph with water and then expecting him to make the water-reinforced bar press. Water would have lost its value as a reinforcer for Rudolph because he had just drunk his fill. So you wouldn't call it extinction. And if the shock is not on, there's nothing to reinforce the rat's bar press; there's nothing to escape from. And you wouldn't call this extinction either.[13]

Once again, how do you extinguish the negative reinforcement response? You turn the shock on, and you leave it on, no matter what the rat does! We have the shock on, and the bar press is ineffective in turning it off; that's like having Rudolph deprived of water and having the bar press ineffective in getting the water, in reducing the deprivation.

In extinction following either positive or negative reinforcement, everything stays the same, except the response no longer has any effect.

We would expect the same sort of results in extinction following negative reinforcement as we get following positive reinforcement. We would expect that the frequency of responding might be high at first and then gradually fall off to zero, *though the shock was still on*. We also would expect decreasing amounts of spontaneous recovery in the following sessions.

Recovery From Punishment

Now we look inside another of the experimenter's Skinner boxes. Here, contingent drops of water reinforce the rat's bar press, and contingent electric shock punishes that response. The result is that the rat spends much time oscillating back and forth between bar presses. So it presses the bar at a much lower frequency than if there were no punishment contingency.

How are you going to show recovery from punishment? This one's easy. Disconnect the wire going from the response lever to the shock generator. Then the response will stop producing shocks. So the frequency of bar presses will gradually increase until it recovers to where it was before, with just food reinforcement and no shock punishment.

QUESTION

1. Describe Skinner box experiments that would show the following and then describe the results:
   - extinction following positive reinforcement
   - extinction following negative reinforcement
   - recovery from punishment
   - extinction and recovery vs. satiation and deprivation

Behavioral Medicine A Complex Intervention Package

FAILURE-TO-THRIVE INFANTS

Five-year-old Mary had been a failure-to-thrive baby and was now a failure-to-thrive child. She suffered from respiratory failure and left vocal cord paralysis, and she had undergone gastroesophageal reflux (acid regurgitation) and stomach surgery. And, she'd never eaten enough food to maintain her growth. Instead of eating food, she'd usually refuse it, spit it out, or pack it (hold it in her mouth, sometimes between her gums and her cheek). Besides being part of her eating problem, packing also put Mary at risk of choking. Mary got essentially all of her food through a gastronomy tube that went directly to her stomach; still, she was malnourished and underweight.

At the Johns Hopkins University Pediatric Feeding and Swallowing Interdisciplinary Clinic, Gulotta, Piazza, Patel, and Layer used a complex, intensive, 6-week intervention to help Mary become a better eater.[14] Every day, they'd do one or two separate sessions for each of three or four meals. At each session, Mary needed to eat 20 bites of food. They'd put a bit of food on her plate and ask her to take a bite. If she did, they'd praise her (hopefully positive reinforcement). If she didn't, they'd hold a spoon with the food up to her lips and prompt her again. But often she'd keep her mouth shut (perhaps avoidance, assuming having food in her mouth was aversive), and they'd keep holding the spoon to her lips until she opened her mouth and accepted the food (extinction of avoidance). Sometimes after accepting the food, she'd spit it out (perhaps negative reinforcement), but the behavior analysts would again put the food in her mouth (extinction of negative reinforcement). Thirty seconds after Mary accepted each bite, they'd say, "Show me," and Mary would open her mouth, which would allow them to check if the food was still there (packed) or if she'd swallowed it. Every time she swallowed the food, they'd praise her and give her toys and tokens (hopefully delayed reinforcement).

This complex intervention got Mary to accept the food into her mouth and not spit it out; but would she swallow it? Not often enough, only 56% of the time; 44% of the time she packed it—held it in her mouth.

So Gulotta and crew recycled to an even more complex intervention: If the food were still in her mouth when they checked, they'd redistribute it on her tongue with a soft bristled brush (maybe punishment of packing, maybe avoidance of the brush [we discuss avoidance in Chapter 17]). And this recycled intervention worked much better; Mary's percentage of packed bites immediately dropped from 44% and soon ended up around 6%. When she was discharged from the clinic, she'd progressed from eating 0% of her food by mouth to eating 50%, and that food was normally textured food, not puréed. Furthermore, several months after her discharge, her packing was so rare that she no longer needed the food redistribution contingency.

Follow-Up

As of 2004, Mary was 10 years old and was still eating 50% of her food on her own, still normally textured food, no food packing (so she was still without the food-redistribution procedure), and without any help from her mother. However, because she still had severe reflux, she still needed to take 50% of her food through a gastronomy tube, but the gastrointestinal specialists hope that, as she continues to grow, her gastrointestinal problems will decrease, and she will be able to take an increasing amount of her food on her own.

Analysis

If things can get screwed up, sooner or later they will. Things we just take for granted. Even things as simple as eating. Seems automatic. But maybe not. Instead, maybe we learn to eat. And for most of us, the reinforcement contingencies are so effective that this learning just happens. No big deal. But for some reason or other, for a small percentage of infants, the behavioral contingencies are so screwed up that they don't learn to eat. Or like Mary, the natural reinforcement contingencies aren't powerful enough to maintain her eating to the extent that she can stay alive, maybe because of the effort required, maybe because of some hidden punishment contingencies, or maybe the food just isn't enough of a reinforcer.

For example, some infants have an undeveloped muscle at the top of their stomach, causing them to vomit their food soon after swallowing. And swallowing may also hurt. As the infants grow older, this muscle strengthens and they may stop vomiting, but it may be too late; swallowing may have been very effectively punished, and escaping and avoiding may have been very effectively reinforced. So as behavior-analytic practitioners, we may need to use several powerful behavioral contingencies at the same time (concurrent contingencies, Chapter 22) to help these children learn to eat. And with complex intervention packages (treatment packages) like this, we may not know which of the components are crucial. But because we behavior-analytic practitioners evaluate our interventions, we can still be sure the complex treatment package helps.

QUESTION

1. Describe a complex intervention package for failure-to-thrive infants.
   - Describe and label the behavioral contingencies that may have caused the problem.
   - Describe the behavioral contingencies that may have been involved in the complex intervention package.
   - What were the immediate results of the intervention and the results during follow-up?

Ethics

EXTINCTION VS. PUNISHMENT

Sid's Seminar

Sid: One of the hottest, most emotional controversies in our field is whether and when you should use punishment to reduce problem behavior.

Tom: It looks to me as if this chapter argues well that you don't ever have to use punishment. You can always use extinction instead.

Eve: I agree that sometimes extinction would be better. But in some cases of self-injury, it might take too long, and clients might injure themselves too much before the response extinguishes.

Sue: And in some cases of self-stimulation, it might not be possible to stop the reinforcement contingency and get extinction.

Max: That's the whole point of a study by Rincover and his buddies. If you're clever enough, you can even use extinction with self-stimulation.

Sue: Maybe, but I'm not sure. I'd like to see more examples where behavior analysts have done that with a variety of forms of self-stimulation before I'd agree 100%.

Sid: Those are all good issues, each worth one point. In summary, maybe we can at least agree that we should use extinction rather than punishment when we can figure out how to do it and when the behavior is not so harmful that the extinction procedure might be dangerously slow.

Joe: I want to file a minority report: I think punishment using a mild aversive stimulus is no big deal. It's no big ethical issue whether a physician gives a drug through a slightly painful hypodermic needle or through painless pills. It may be a practical issue, though. If you use the needle, you know the patient got the drug, but often patients forget to take the pills.

Tom: So?

Joe: So, just as with the physician, I think it's no big ethical issue whether the behavior analyst uses extinction or mild punishment. It may be a practical issue, though. If you use punishment, the behavior may stop more quickly.

Sue: I think it's strange that we don't talk about extinction as an aversive procedure. Basically, we've implied that extinction is gentle and non-aversive, but I think that being in extinction is very aversive. Nothing irritates me more than putting my dollar into a pop machine only to have it spit back at me without a pop. If I think that's aversive, maybe people with problem behaviors find extinction to be aversive too.

Sid: Another good point, Sue. Extinction can be aversive, though it isn't usually talked about that way.

QUESTION

1. What are the ethical issues involved in using extinction rather than punishment?

Ethics

THE MORAL NECESSITY TO EVALUATE INTERVENTIONS (E-4)

Though it was important to help Laura with her particular vomiting problem, the study has an even greater value: Vomiting of this sort is more common among young children than you might think. The high frequency of this problem demands a solution. The present study shows not only that we can accidentally reinforce such vomiting, but it also shows that we can use applied behavior analysis to get rid of the problem. This study points out the importance of the extinction procedure as a tool for the behavior analyst.

When using a new behavioral intervention, we have a moral obligation to collect data and carefully evaluate the effectiveness of our intervention. Then we have a moral obligation to publish the results as a scientific experiment that shows the effectiveness of the intervention. In this way, behavior analysts not only directly help the person they're working with but they also indirectly help hundreds or even thousands of other people. Such long-range concerns mark behavior analysts who are also scientists. When we treat applied behavior analysis as an experiment, we show concern not only for the individual but also for all humanity.

QUESTION

1. Why is it morally necessary to evaluate novel interventions?

Research Methods

THE REVERSAL DESIGN[15]

Dr. Montrose Wolf and his colleagues needed to evaluate their intervention with Laura to provide effective applied behavior analysis that would help other children. But also, for Laura's sake, they needed to be certain that the teacher's attention and Laura's removal from the classroom reinforced vomiting. They needed to be certain so they could advise the residence hall personnel and future teachers how to manage Laura's behavior if she ever started vomiting again. Because this intervention was so new and radical, they especially needed to convince the skeptics. You can imagine how hard it would be to convince a teacher who didn't know the principles of reinforcement that the way to stop Laura from vomiting would be to let her vomit as much as she "wanted."

It is possible that the extinction procedure had nothing to do with the decrease in Laura's vomiting. The decrease might have been mere coincidence and not the result of her teacher's no longer unintentionally reinforcing her vomiting. (Presumably, the teacher had unintentionally reinforced the vomiting by paying attention to it and also by removing her from the classroom when she vomited.) They were going to use a reversal design—a research design in which they reverse the experimental conditions to assess the effects of those conditions. How would they do it? They'd try to reinforce the response again, and they might even try to extinguish it a second time. The frequency should go up when they again reinforce the response and down when they again re-extinguish it. If this happened, they would have much more confidence that the attention and the removal from the classroom acted as a reinforcer for her vomiting; they would know they were not dealing with a coincidence.

But to reinforce the vomiting, they had to wait until Laura vomited. The extinction procedure had been so effective that they had to wait for more than 50 class periods before she vomited. At that point, the teacher began reinforcing vomiting. The teacher reinforced vomiting for 51 more class periods. As soon as Laura vomited once, the teacher took her out of the class for the rest of the day. This meant she could vomit no more than once per day during the reinforcement phase. Laura vomited on 23 days of the reinforcement phase, and toward the end, she vomited nearly every day.

Of course, Mont, his colleagues, and for sure the teacher were unwilling to let things stand at that. They had made their point—attention and escape from class were the culprits. Now they insisted on doing one more reversal; they insisted on extinguishing the response again. If they succeeded with this final extinction phase, they would have achieved two goals. They would have even more clearly shown that the attention and Laura's removal from the classroom reinforced vomiting, and they would, again, have gotten rid of Laura's serious problem, a problem that prevented her education.

During this final extinction phase, the teacher kept Laura in the class for the entire 1 1/2-hour period. This meant Laura could vomit more than once per class, and she took frequent advantage of that opportunity. During the first part of this extinction phase, she vomited as many as 29 times in a single class period. It may seem strange that the frequency was higher during the first part of extinction than it was during the previous reinforcement phase, but remember that Laura could vomit only once per day during the reinforcement phase. Mont and his colleagues could not show the effectiveness of this procedure until she could vomit an unlimited number of times. Eventually, however, the extinction procedure took effect, and the frequency of vomiting decreased to zero; by the end of 34 more class periods in extinction, vomiting had stopped completely. The presumed reinforcers for vomiting were removal from the classroom and attention. As Mont and his colleagues withheld, presented, and again withheld the presumed reinforcers, the frequency of vomiting decreased, increased, and finally decreased again. This evidence should convince the most skeptical that Mont Wolf and his crew were not presumptuous in their presumption.

QUESTION

1. Explain how to use a reversal design to show that attention and removal from the classroom can reinforce vomiting.

Richard's Rant

ETHICS (F-3)

We've talked about the moral necessity to evaluate our interventions carefully and publish the results when we find something that works, because our results may help so many more people than just the kids we're working with. Furthermore, applied behavior analysis and the BACB requirements make a big deal out of professional ethics. But I think there's one area that's falling through the cracks—treating the kids or clients we're trying to help as if they were guinea pigs for our research.

1. Whenever we're doing research trying to find the best ways to teach some specific skill to our kids, we're also morally obligated to make sure the skill is something the kid can actually use, once our research is done. For example, in developing a procedure to train concepts, as researchers, we

want to make sure our experiments are as clean as possible, as unconfounded as possible. We want to make sure it was really our independent variable that was responsible for their improved concept mastery and not something Mama was doing with the kids at home. So, for example, to be sure, we often teach concepts that have no relevance to the kids' life and never will. Our experiment is clean, but our conscience shouldn't be. The clock's ticking on these kids. We need to give them as much functional, useful training as we can, as soon as we can, if we're going to really help them achieve something resembling the life everyone wants for them. We can't waste any of their precious time, teaching them nonsense syllables and nonsense pictures.

2. Yes, some famous behavior analysts have argued that the kids' time in our experiments is just the price the kids are paying us for the wonderful services we're providing them. But that sounds a little bit like big-time-researcher rationalization. Think about it, when it's your time to do your thesis or dissertation. Easier said than done.

Ethics and Research Methods

INFORMED CONSENT AND SOCIAL VALIDITY[16] (E-9)

The behavior analysts also described various possible interventions, with their risks and benefits.

Then they explained that the parents could ask the behavior analysts to stop the intervention anytime they wished. Only after all these issues had been discussed did the behavior analysts ask the parents for their informed consent to intervene. This informed consent process is ethically and legally crucial whenever we use an experimental intervention or aversive control, even one with an aversive outcome as mild as this set of exercises.

Definition: CONCEPT

Informed consent

- Consent to intervene
- in a way that is experimental or risky.
- The participant or guardian
- is informed of the risks and benefits
- and of the right to stop the intervention.

Even if an intervention works, the participants might not like it. For example, they might not think it was worth the effort, or they might think it had negative side effects. An intervention can be behaviorally valid (it works) but not socially valid (people don't like it). So the behavior analysts individually asked the participating teacher and teacher's aides about it. Each said it was effective, and some mentioned that such a procedure would generally not raise objections (a problem with using electric shock). Also, later, the teacher independently used contingent exercise as an effective punishment procedure in reducing other problem behaviors and in working with other children. All this suggests that the procedure is socially valid.

Social validity tells us whether we have selected what our clients consider socially significant **target behaviors**—*those worthy of improving*. Social validity also tells us whether we have an acceptable intervention, to some extent regardless of its outcome.

A complete social validity will also tell us how acceptable our intervention is. For example, even though a problem student may get straight *A*s as a result of an intervention we recommended, we've failed if our intervention required more work from the teachers than they believed appropriate.

QUESTION

1. *Informed consent*—define it and give an example.

Richard's Second Rant

NO INFORMED CONSENT (E-2)

Possibly the most unethical research ever done in America was the Tuskegee syphilis experiment,[17] where a control group of 300 Black men were prevented from getting effective treatment, resulting in lifelong syphilis, transmission to wives, and children born with congenital syphilis. No **informed consent**. And this notorious research may have been a major reason that essentially all human research now requires informed consent. Check out *Miss Evers' Boys*[18] with Alfre Woodard and Laurence Fishburne—an excellent movie that tells the story very well.

I didn't learn about the Tuskegee syphilis experiment until I was well out of grad school; but when I was in high school, my dad turned me on to Sinclair Lewis's novel *Arrowsmith*; he'd read it while he was in med school. *Arrowsmith* is also about medical researchers who put such a high priority on the need for scientifically rigorous control groups that their participants aren't given the opportunity for **informed consent**, even though being in the control group will probably be fatal. It's about putting a higher priority on science than the well-being of the participants, about treating human beings as if they were guinea pigs. And, aside from that, it's an excellent read. I really liked *Arrowsmith* at the time; but it wasn't until I reread it, just a few years ago, that I discovered not only that I still really liked it but also that *Arrowsmith* had had a very profound effect on my approach to research in applied behavior analysis. It's because of Sinclair Lewis's *Arrowsmith* that I developed the notion of the ***science-based practitioner***[19] and that I try to train my students to be science-based practitioners of behavior analysis, not the more popular ***scientist practitioners***. Here's the way we break it down:

Our Practitioner Project, Thesis, and Dissertation Goals

1. It must help the participating children and family.
2. It must help the participating classroom or center.
3. It must help get the practitioner a BA, MA, or PhD.
4. A publication would be nice, but it ain't crucial.

These are our goals in descending order of importance; whereas, the order of importance seems to be in the opposite direction for the scientist practitioner.

Please check out *Miss Evers' Boys* and even *Arrowsmith* and let me know what you think about them.

QUESTION

1. Please describe the Tuskegee experiment.

Compare and Contrast

RECOVERY FROM PUNISHMENT VS. SPONTANEOUS RECOVERY FROM EXTINCTION

Two of the major ways we can reduce the frequency of behavior are punishment and extinction. So *recovery from punishment* and *spontaneous recovery from extinction* both involve recovery (an increase in frequency of behavior whose frequency had previously reduced). Recovery from punishment occurs when we stop punishment contingencies involving either the presentation of aversive conditions or the removal of reinforcers. But to explain spontaneous recovery, let's go back to the Skinner box: For several sessions, we reinforce Rudolph's lever presses. Then for one session, we extinguish it. First, we get an extinction burst, and then his response rate decreases to zero. But the next day, after 23 hours outside of the Skinner box and away from the lever, we put Rudy back in the box and his responding spontaneously recovers, before it falls back to zero. Each day we repeat this, we get less and less spontaneous recovery, until it eventually stops occurring—it completely extinguishes (Figure 10.8).

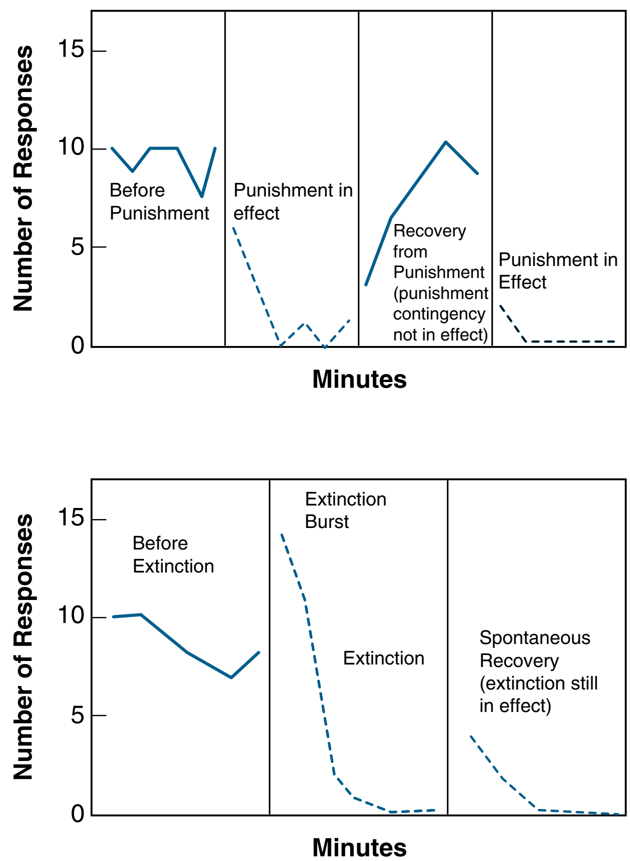


Figure 10.8 Recovery From Punishment (top); Spontaneous Recovery (bottom)

In recovery from punishment, the response frequency recovers to the frequency occurring before the punishment contingency. And recovery maintains unless we start the punishment contingency again. But in spontaneous recovery, the response frequency is lower than when the reinforcement contingency was in effect. And recovery is only temporary.

Recovery From Punishment vs. Spontaneous Recovery

	Procedure	Results	To Eliminate Recovery
Recovery From Punishment	Stop the punishment contingency.	Response rate recovers to level before punishment.	Start the punishment contingency again.
Spontaneous Recovery	Continue the extinction sessions.	Response rate recovers briefly at the beginning of each extinction session.	Continue the extinction sessions.

QUESTIONS

1. Compare and contrast recovery from punishment and spontaneous recovery from extinction. In other words, what are their similarities and differences? (Hint: Some students find it helpful to memorize which kind of recovery goes with each procedure.)
2. And, as always, whenever you see a table in the text, learn it. Be able to fill it out even if the rows and columns are switched around on you.

Notes

1 This study and its graphs are based on Piazza, C. C., Hanley, G. P., Bowman, L. G., Ruyter, J. M., Lindauer, S. E., & Saiontz, D. M. (1997). Functional analysis and treatment of elopement. *Journal of Applied Behavior Analysis, 30,* 653–672.

2 Based on Zimmerman, Elaine H., & Zimmerman, J. (1962). The alteration of behavior in a special classroom situation. *Journal of the Experimental Analysis of Behavior, 5,* 59–60.

3 This is a more complex form of response cost than we've seen before. What is lost is a future reinforcer (the dessert the nephew *will* get, not one he now has). In a later chapter (11), we'll study this *punishment by the prevention of the presentation of a reinforcer*.

4 This case and the graphed data are based on Rincover, A., Cook, R., Peoples, A., & Packard, D. (1979). Sensory extinction and sensory reinforcement principles for programming multiple adaptive behavior change. *Journal of Applied Behavior Analysis, 12,* 221–234.

5 Based on Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18,* 111–126.

6 Based on Carr, E., Newsom, C. D., & Binkoff, J. (1980). Escape as a factor in the aggressive behavior of two retarded children. *Journal of Applied Behavior Analysis, 13,* 101–118.

7 Based on Wolf, M., Burnbrauer, J., Williams, T., & Lawler, M. (1965). A note on apparent extinction of the vomiting behavior of a retarded child. In L. P. Ullmann & L. Krasner (Eds.), *Case studies in behavior modification* (pp. 364–366). New York: Holt, Rinehart & Winston.

8 Based on Dorsey, M. F., Iwata, B. A., Ong, P., & McSween, T. (1980). Treatment of self-injurious behavior using a water mist: Initial response suppression and generalization. *Journal of Applied Behavior Analysis, 13,* 343–353.

9 As behavior analysts, one of our responsibilities is to fade our interventions back to normal levels whenever possible. But we also shouldn't try to remove them too soon. Reversal designs often show us that the punished behavior can quickly return to higher levels when the punishment contingency is removed if the behavior has not been suppressed to the point where it rarely occurs. If you can get it down to zero, then it's much more likely to stay there even after you remove the supports.

10 Based on Charlop, M. H., Burgio, L. D., Iwata, B. A., & Ivancic, M. T. (1988). Stimulus variation as a means of enhancing punishment effects. *Journal of Applied Behavior Analysis, 21,* 89–95.

11 Based on Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18,* 111–126.

12 Maurice, C. (1993). *Let me hear your voice: A family's triumph over autism*. New York: Random House Publishing Group. This book is required reading for all of our undergrad and grad students in our autism practicum; and in writing it, Catherine Maurice may have done more for the treatment of autism than any other individual. But I don't think she wrote it for university students; instead, she wrote it for other parents of children with autism. And with that book in one hand and an attorney in the other, those parents have successfully demanded that their children get behavior-analysis treatment, which is why there are now over 40,000 MA-level Board Certified Behavior Analysts in the United States. Also, if you take the right courses as an undergrad, you can become a Board Certified Associate Behavior Analyst, which 4,000 people have done. And with only a high school diploma and a little training, you can become a Registered Behavior

Technician, as 7,000 have done, which would allow you to do some behavior-analysis relevant, worthwhile work, while you're in college; especially cool, if you're tired of being wait staff in a restaurant.

13 This part is a little gruesome. We don't know that anyone has actually done this extinction experiment with shock.

14 Gulotta, C. S., Piazza, C. C., Patel, M. R., & Layer, S. A. (2005). Food redistribution to reduce packing. *Journal of Applied Behavior Analysis*, *38*, 39–50.

15 Based on Wolf, M., Burnbrauer, J., Lawler, M., & Williams, T. (1967). The operant extinction, reinstatement, and reextinction of vomiting behavior in the retarded child. Unpublished manuscript.

16 An outstanding reference for informed consent, social validity, and many other ethical issues is Bailey, J. S., & Burch, M. R. (2005). *Ethics for Behavior Analysts: A practical guide to the Behavior Analyst Certification Board Guidelines for Responsible Conduct*. New York, NY: Routledge.

17 Tuskegee Syphilis Experiment. (2020, July 22). *Wikipedia*. Retrieved from https://en.wikipedia.org/w/index.php?title=Tuskegee_syphilis_experiment&oldid=967704214

18 *Miss Evers' Boys*. (2020, July 22). *Wikipedia*. Retrieved from https://en.wikipedia.org/w/index.php?title=Miss_Evers%27_Boys&oldid=957509617. You can get it on a DVD from Netflix or watch it on HBO; or maybe your instructor will have a special movie night!?!?!?

19 Malott, R. W. (2018). A science-based practitioner model. *Education & Treatment of Children*, *41*, 371–384; Malott, R. W. (2018). A model for training science-based practitioners in behavior analysis. *Behavior Analysis in Practice*, *11*, 196–203.

CHAPTER 11

Differential Reinforcement and Differential Punishment

Behavior Analyst Certification Board 5th Edition Task List Items		
B-1	Define and provide examples of behavior, response, and response class.	Pages 200–201
C-3	Measure occurrence (e.g., frequency, rate, percentage).	Throughout
C-4	Measure temporal dimensions of behavior (e.g., duration, latency, interresponse time).	Pages 196–197
C-5	Measure form and strength of behavior (e.g., topography, magnitude).	Page 198
G-14	Use reinforcement procedures to weaken behavior (e.g., DRA, FCT, DRO, DRL, NCR).	Throughout

Example of Differential Reinforcement of Alternative Behavior Behavioral Special Education

JIMMY, THE CHILD WITH AUTISM—PART VIII (G-14)

In Chapter 7, we read about Jimmy when he first started at Mae's center. When presented with a task, he would swipe or throw the materials, yell, or tantrum. His behavior technician, Sue, was having trouble getting any work done due to Jimmy acting out. Dr. Mae Robinson conducted a functional assessment to determine what reinforcement contingency was responsible for Jimmy's bad behavior. Her data showed that negative reinforcement by the removal of the aversive work tasks reinforced the behavior. We pick back up with Mae and Sue discussing the next step.

"I'm glad we figured out what the problem is, but I'm not sure how to fix it," said Sue. "It's hard not to react to Jimmy when he gets so worked up. It's so tempting to try to calm him down."

"It sure is," Mae replied. "I sympathize with you completely, and I may have some good news. I've been reading about an interesting technique—**differential reinforcement of alternative behavior**. It might help us deal with this problem, and we sure need to deal with it right away.

"We both suspect that getting a break from work is reinforcing for Jimmy. Nothing wrong with that; that's normal. What's wrong is the response that gets that break. So far, escaping from difficult tasks has reinforced his disrupting. As a result, no matter what tasks he works on, Jimmy screams, or pulls his hair, or hits. And we can't get any teaching done while he's disrupting."

"Yes, but what's differential reinforcement of alternative behavior, Dr. Robinson? I've never heard of it." Sue smiled for the first time since the start of the evaluation session.

"It's complex. When life gets confusing, I always take a look at *Principles of Behavior*."

Sue wasn't sure whether Mae was serious or joking.

Mae said, "Take a look at this definition," as she opened the book to a marked page.

Definition: CONCEPT

Differential reinforcement of alternative behavior (DRA)

- Withholding reinforcement for an inappropriate response,
- while providing reinforcement for an appropriate response.*

Note that that *reinforcement* could be either the presentation of a positive reinforcer or the removal or reduction of a negative reinforcer (aversive stimulus).

"In the future, you should *differentially reinforce a more appropriate alternative response*. We find a *functionally equivalent behavior* and reinforce that instead of his inappropriate behavior. So, only when Jimmy makes a more appropriate alternative response will you provide the reinforcer of a break from work.

"There's a clear pattern to the way Jimmy disrupts. He never causes problems in the picture-matching sessions. And if you look at the functional assessment data we recorded, he always causes problems in the picture identification sessions where he has to point to the picture that matches the word you've spoken."

"Why is that?" Sue asked.

"I think those sessions are too hard for him."

"Could be," Sue said.

"I think working on those hard tasks is aversive for Jimmy. And what happens when he disrupts? We immediately stop insisting he work on those aversive tasks. Instead, we start trying to cope with his disrupting. And while we are coping, we obviously stop working for a few moments. So, without meaning to, we're reinforcing his disrupting by allowing him to escape briefly from the negative reinforcers, the aversive academic tasks."

Inappropriate Natural Contingency

Before	Behavior	After
Jimmy must deal with a task that's too hard for him.	Jimmy disrupts.	Jimmy need not deal with a task that's too hard for him.

"But I don't know what else to do. I can't just sit there and let him pull his hair out."

"Right, I'm not blaming you, Sue," Mae answered. "We'd all do the same thing, in your place."

"What should I do?" Sue asked.

Mae said, "So far, you've used the presentation of a reinforcing condition, your approval and affection, after each correct response Jimmy makes. Now let's add a contingency for the removal of a negative reinforcer—tasks that are too hard for him. Help him acquire a normal, nondisruptive alternative, functionally equivalent response that will allow him to escape the aversiveness of tasks that are too hard."

"How could I do that?" Sue asked.

"You should establish the healthy alternative response of asking for help. And the alternative response will remove the negative reinforcer of struggling with a task that's too hard for him. Of course, we'll have to teach him the new response, and prompt him frequently."

"It's beginning to make sense," Sue said, returning to her former smiling self. "So, every 30 seconds I'll ask, 'Do you need help?' And I'll prompt with something like, 'Say, help.' And instead of praising him when he says help, I'll just help him."

Performance-Management Contingency

Before	Behavior	After
Jimmy must deal with a task that's too hard for him.	Jimmy asks for help.	Jimmy need not deal with a task that's too hard for him.

"I think you've got it. What kind of help would you give him if he asked for help on a picture identification task?" Mae asked.

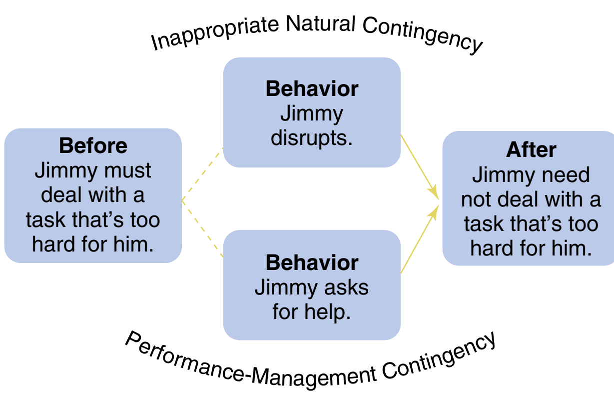
* Sometimes it is not possible to completely withhold reinforcement for the inappropriate behavior. In such cases, it may be possible to provide quicker or stronger reinforcement for the appropriate behavior.

"If he were having trouble with the word-picture pair for horse, I'd answer his request for help by pointing to the picture of the horse and saying, 'Horse.' Then I'd say to him, 'Point to horse.'"

"Go for it, Susan."

Here's a way of showing the relation between those two previous contingencies that may help you better understand differential reinforcement of alternative behavior.

Differential Reinforcement of Alternative Behavior



Check out this diagram and note that when you do differential reinforcement of alternative behavior,

- the before and after conditions are the same for the new performance-management contingency as they are for the inappropriate natural contingency, and
- you've just substituted an appropriate behavior in the performance-management contingency for an inappropriate one in the natural contingency.

The results? The use of differential reinforcement of an appropriate alternative escape response (asking for help) got rid of the inappropriate escape responses (the disruptive behavior). So Sue and Mae got rid of most of Jimmy's inappropriate behavior during the teaching sessions by using differential reinforcement of alternative behaviors with negative reinforcement (Figure 11.1).

And you? You've learned about differential reinforcement of alternative behavior. This case illustrates one of the two uses of differential reinforcement of alternative behavior—it can be used to get rid of inappropriate behavior maintained by positive reinforcement and to get rid of inappropriate behavior maintained by negative reinforcement (like Jimmy's). And note, in this case they did not use a punishment procedure to get rid of the inappropriate behavior.*

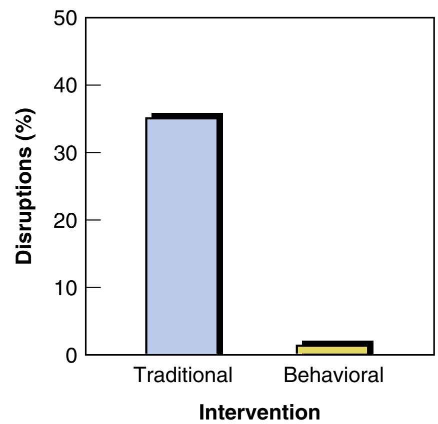


Figure 11.1 Disruptive Escape Responses (Tantrums, Self-Injury, Opposition) When Given Hard Academic Tasks

PROMPTING ALTERNATIVE BEHAVIOR

Note that Sue didn't just sit there waiting for Jimmy to do the appropriate behavior, like asking, "Help?" If she had, they might have sat there forever. Instead, she used a verbal prompt; she said, "Say, 'Help.'" Most generally you need to use some sort of prompt to get the desirable alternative behavior going. But what if the child had no language skills? Then you might use a physical prompt, physical guidance, to prompt alternative behavior like hand raising, which would then be reinforced with help or attention from his behavior tech.

Also note that Sue didn't wait until Jimmy engaged in problem behavior before she prompted the appropriate response. She did it *before* he engaged in problem behavior. If she had waited until he yelled or swiped the materials before prompting him to ask for help, she may have unintentionally reinforced those behaviors.

* Some research suggests that the necessary component in procedures such as these is not that we differentially reinforce alternative behaviors but that we have stopped reinforcing the undesirable behaviors and that, without reinforcement, those undesirable behaviors decrease in frequency regardless of whether we differentially reinforce alternative behaviors. In any case, it seems the humane thing to do—helping our clients acquire appropriate alternative responses to get their reinforcers and to escape aversive stimuli. The procedure of withholding reinforcement is called extinction, as you'll recall from Chapter 10.

QUESTIONS

1. Define *differential reinforcement of alternative behavior (DRA)*.
2. And give an example with
   a. the responses
   b. the reinforcement contingencies
   c. the presumed reinforcers
   d. the results
   e. any other interesting feature of the intervention, hint hint. like prompting

Example Behavioral Sports Psychology

TERRIBLE TENNIS[1]

Principal: I want to get rid of it; IT DOES NOT WORK! (He paused for a few seconds embarrassed, cleared his throat, and gave it another try with a softer tone.) You know, every year, the girls' tennis team plays so poorly they disgrace our entire junior high school.

Juke: I don't blame you for wanting to get rid of your tennis team. I'd feel the same way, if I were you. The team did have a bad season last year.

Principal: And the year before that! And the year before that! Ever since we've had a team.

Juke: But, still, isn't tennis the most popular girls' sport in your school? What would happen if you disbanded the team?

Principal: I'd have all heck to pay. But our team never makes it past the first match in the league playoffs anyway. And we're the laughingstock of the school district. We were even the butt of half the jokes at the last principals' meeting!

Juke: I see. (Complete silence for a few seconds.) Well, here's what I've found in coaching. You get out of it what you put into it. The best teams get the best training. They don't play well just by accident; they . . .

Principal: Darn it, Juke, you gave me the same mumbo jumbo last year when I wanted to disband the team. Remember, I followed your advice and hired a new tennis coach. It still didn't work.

Juke: You've got me there, Albert. Maybe the coach needs coaching. Tell you what: If you keep the team one more season, I'll work with the coach and see if we can't turn things around.

Principal: More than generous of you, Juke, but frankly, why do you think you can do any better than our regular tennis coach? I've known you for a long time, and I've never seen you with a tennis racket in your hand.

Juke: Hilary Buzas and Ted Ayllon at Georgia State have worked it out. I think if we just apply the technology they've developed, we'll make big progress. I've used Ayllon's approach in other sports; it always works.

Principal: You're a slick-talking son-of-a-gun, Juke. Here's what I'll do: You have 5 weeks before the regular training season starts. You and Coach Craigflower take the three worst klutzes and see what you can do. If you impress me with them, then I'll keep the team for one more season; and you can use your fancy Buzas–Ayllon behavioral techniques on the whole bunch of 'em.

Coach Craigflower was happy to work with Juke. They selected three basic skills to improve: the forehand, the backhand, and the serve. Then they did a task analysis of the skills, breaking each skill into five to nine components. For instance, among other behaviors, the forehand return of a right-handed player includes the following:

- When striking the ball, pivot and step toward the net with your left foot forward.
- Transfer your weight from your right foot to your left foot.

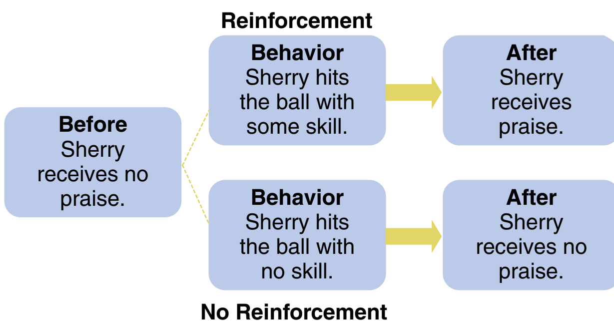
(Of course, behavior analysts usually can't do this sort of task analysis and intervention by themselves. They need an expert in the field to help with the component analysis. And also, they may need an expert to recognize when the component responses are correctly performed during baseline and intervention.)

Craigflower chose the three worst beginners, and Juke collected baseline data. During baseline, Coach Craigflower instructed her players as usual. She started each session with a 5- or 10-minute lecture and demonstration of all the components of the three targeted skills. Then she corrected them as they practiced those skills. She mainly criticized their errors, and she mainly ignored correct or nearly correct components of each skill. For example, for Sherry, on average, Coach Craigflower criticized her performance 23 times and praised it five times per practice session.

Yes, they had picked three lousy players; all three were terrible at all three skills. Sherry's results were typical for the three. Juke computed the percentage of serves and returns where Sherry got all the components correct. What do you think it was? Twelve percent! And that was for 16 practice sessions. In other words, she wasn't going anywhere.

After Juke, the careful scientist, got his baseline data, he was ready to make his move—the behavioral intervention. He asked Coach Craigflower to stop all criticisms and just use praise. But instead of waiting for a player to do all the components of an entire skill correctly, he asked her to praise any nearly correct component.

Differential Reinforcement



And Coach did a good job implementing the procedure. In working with Sherry, her criticisms went down from 23 times a session to two times a session. And her praises went from five per session to 21 per session. You can imagine life was a lot more pleasant for Sherry and the other players during the behavioral intervention.

But what about the players' performance? Our typical player, Sherry, went from 12% correct to 49% correct in 15 practice sessions (Figure 11.2). With a traditional approach, she'd gone nowhere for 16 sessions; with reinforcement, she quadrupled her performance in 15 sessions.

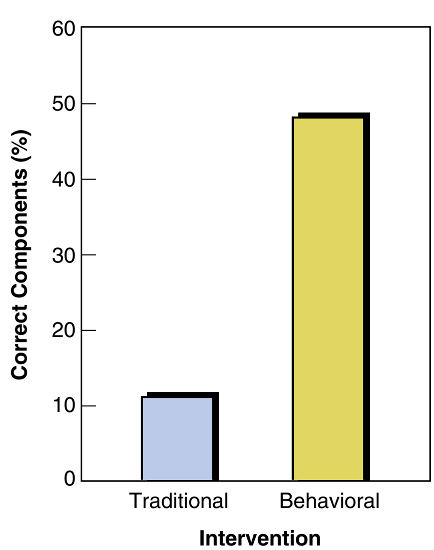


Figure 11.2 Task Analysis and Differential Reinforcement of Components of Tennis Skills

Oh, yes, these results so impressed the principal that he let the team play for that season. And with their new behavioral coaching procedure, they placed third in their league.

QUESTION

1. Describe a behavioral intervention to improve tennis skills. Specify:

- the responses
- the reinforcement contingencies
- the presumed reinforcers
- the results
- any other interesting feature of the intervention

Concept

TASK ANALYSIS

Before he intervened with the players, Juke did a **task analysis**. He and the coach broke each task or skill into its detailed component skills. Then the coach could evaluate a player's skills according to each component and reinforce and give feedback more precisely. Instead of just saying, "Good," Coach Craigflower could say, "Good follow-through," or "Good grip."*

It often helps to do task analyses when training complex behaviors: sports, dance, table manners, writing poetry, doing a behavior analysis. And it also often helps to do component analyses when managing already established performance: sportsmanship, working industriously, interacting pleasantly.

* In an earlier chapter, we warned against using too much language when delivering praise with nonverbal children. In this case, descriptive praise is OK because the players had very strong verbal repertoires, unlike little Jimmy. Oh yes, and ***descriptive praise*** just means that when you praise what someone has done, you describe the behavior you're praising. You don't just say, *That was cool*. Instead you say something like, *That was cool the way you replied so respectfully to our professor's mentalistic question, even though he didn't really deserve that respect*.

Definition: CONCEPT

Task analysis

- An analysis of complex behavior
- and sequences of behavior
- into their component responses.

When you do a task analysis, you're looking at the process and not just the final product: the sequence of motions in the serve or return and not just where the ball lands on the opponent's side of the net; lateness, time on task, time at the water cooler, and not just number of pages typed per day.

Sometimes you need only reinforce or give feedback on acceptable final performance—on product. That makes life simpler for the behavior modifier or performance manager. But if that isn't working, then you need to address the details of the process.

Definition: GENERAL RULE

Process vs. product

- Sometimes you need to
- make reinforcers and feedback contingent on
- the component responses of the process,
- not just the product (outcome).

When you can't get quality products of sufficient quantity, make reinforcers and feedback contingent on the component responses of the process, even though you've made reinforcers and feedback contingent on the ultimate production of those products.

For example, suppose you praise a child's performance each time she completes a long-division problem. But suppose she rarely completes the problems, and when she does, her answers are wrong. You may need to do a task analysis and make reinforcers and feedback contingent on each component in the task of doing long division. In fact, the first component you might have to reinforce is the child's sitting in her seat.

QUESTIONS

1. *Task analysis*—define it and give an example.
2. *Process vs. product*—state this general rule and explain how you can apply it in sports.

Concept

RESPONSE DIMENSIONS (C-4) (C-5)

The forehand tennis swing differs from the swing of a baseball bat and the swing of a golf club. The bat moves on a horizontal plane and then arcs to the left, for the right-hander. The club moves on a vertical plane, going from the tee to high above, then pausing and changing direction. The movements in a swimming stroke differ greatly from those of dancing or running track. We call these differences of movement differences in **response topography**. If you extend your little finger when you daintily drink tea, you're using a response topography different from the one I use.

Definition: CONCEPT

Response topography

- The sequence (path of movement),
- form,
- or location of components of a response
- relative to the rest of the body.

Here's what we mean by two responses that differ in topography because they differ in the *sequence or path of movement*: Suppose you and I both write the word *slob*. Our resulting handwriting will be much different—yours precise, sensitive, pleasant, artistic, legible; mine sloppy, illegible, smudged, torn, scarred by broken pencil leads, eraser-marred—work of a true slob. The handwriting is the result of our making the same response but with slightly different sequences of movement—in other words, with slightly different topographies.

Here's what we mean by *form*: There are many ways to do push-ups. If you're using the correct form, your back should be straight. If, like me, you tend toward butt-in-the-air push-ups, you are using incorrect form. As another example, two divers competing in the Olympic Games may use different forms when executing the same dive (e.g., one points his toes while the other doesn't). My trainers at the fitness center are always on my case about my poor response topography—my form: "When you're biking, keep your knees and elbows in and don't point your feet down." "When you lift those weights, bend your knees slightly and also keep your gut tucked in." And of course your mom's on your case about sitting and standing straight, "Stop slouching"—that's form.

Here's what we mean by *location relative to the rest of the body*: If you wave your hands above your head, that's a different location than if you wave them below your head. So waving your hands in the two locations represents two different topographies. Location in space is with reference to the body of the person making the response. And my trainers instruct, "Now when you lift this weight, hold it out from your body and only lift it up to eye level."

As far as *topography* goes, "It ain't what'cha do; it's the way that'cha do it." If Rudolph the Rat presses the lever with his right paw, that's a different topography than if he presses with his left paw or his nose; Rudolph does press the lever, but there are topographically different ways he can do it. So responding with different parts of your body also illustrates differences in topography.

Different cultural groups have different ways of walking, as do men and women and people of different ages. It's all the same response class but different topographies. You'll get to your reinforcing goal whether you walk gracefully or awkwardly; the only difference is your style, your response topography.

Now here's a common confusion: Students often confuse response topography in terms of response location relative to your body with response location relative to the external environment. Suppose you have two levers in your Skinner box. Rudolph can press either the right or the left lever. So now the responses can differ according to their location relative to the Skinner box (e.g., the right or left lever), and they can also differ according to their location relative to Rudolph's body (e.g., pressing with his front leg extended directly in front of him or pressing with his front leg extended from his side). Pressing the right vs. the left lever is an example of stimulus discrimination, not response differentiation. Rudolph is "discriminating" between two elements of his environment, the right and left levers. (Don't worry, we'll hit on this more in Chapter 14.)

But responses can differ in more than topography. These potential differences are the ***dimensions of the response***. Besides topography, other dimensions include **force*** (the loudness of your voice when you speak in public), **duration** (the duration of each key press when you use your pocket calculator), and **latency** (the time it takes you on an oral quiz to name the concept when your professor gives you the definition).

You put Rudolph in the Skinner box (opportunity for a response), and he wanders around for a few seconds (latency of the response) before he presses the lever. Then he holds the lever down for a couple seconds (duration of the response).

Definition: CONCEPT

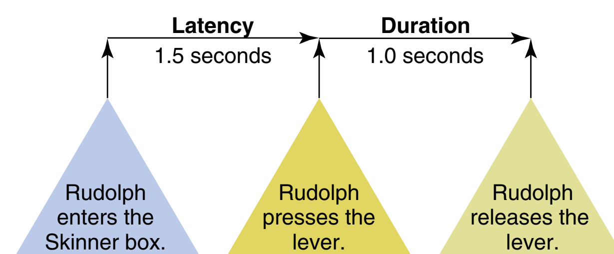
Latency

- The time between
- the signal or opportunity for a response
- and the beginning of that response.

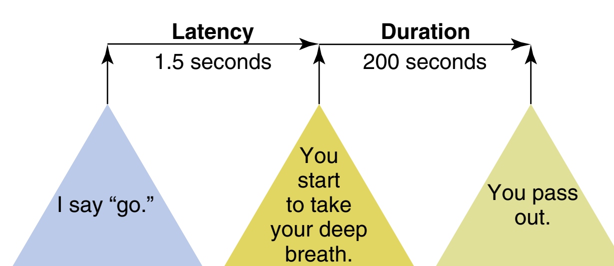
Definition: CONCEPT

Duration

- The time from
- the beginning
- to the end
- of a response.



The difference between duration and latency often confuses students. So let's check it out again: When I say "go," I want you to take a deep breath and hold it as long as you can. Now think about the time between when I say "go" and when you start to take your deep breath. Which is it—the latency of the response or the duration? And think about the time between when you start to take your deep breath and when you pass out. Which is it—latency or duration? Right; we measure the latency from "go" to the start of your deep breath, and we measure the duration of the time you hold that breath.



* Often we use the term *intensity* rather than *force* when speaking of loudness. But the two terms mean about the same thing. We often speak of the *force* of a response and the *intensity* of a stimulus.

We also could measure the latency between when Father finishes saying grace at the dinner table and when you have your fork loaded with peas. And we could measure the latency between when you load your fork and when you deliver those peas to your mouth; but this is a slightly unusual use of the term *latency* because it's the time between one of your responses (loading your fork) and another of your responses (dumping the peas in your mouth). Most often we measure the latency between some external event (like the end of the prayer) and your response.

QUESTIONS

1. What is the time between the light turning green and your slamming your foot down on the accelerator?
    a. response duration
    b. response latency
2. What is the length of time during your blowing your horn at the driver in front of you who doesn't notice the light has turned green?
    a. response duration
    b. response latency

Definition: CONCEPT

Response dimensions

- The physical properties of a response.

Topography, latency, and duration are examples of **response dimensions**. They're physical properties of a response. Here are some other physical properties or dimensions of a response: ***force*** (how hard the batter hits the ball, how loudly you cheer when the ball soars over the outfield wall) and ***pitch*** (how high you have to sing when you struggle through our national anthem). The skill with which Sherry served the tennis ball was a dimension composed of several components such as pivoting, moving forward, and transferring her weight.*

By the way, you sometimes have to watch out for metaphorical or poetic uses of these terms. For example, Dawn might say, "Sid is studying intensely." But that differs from shouting intensely; studying intensely is not a response dimension. What Dawn really means is that Sid is studying continuously without interrupting his studying by making other responses, such as looking around or chatting.

We can classify responses according to their dimensions, but also we can classify them according to their function—their effects on the environment: pressing a lever, getting a laugh, totaling a car, or ringing a doorbell. Now most of us would ring the doorbell with our index finger. But we might make the bell ring by pressing the button with our little finger, big toe, elbow, forehead, nose, chin, or rear end (just stand tall). Though each response differs in topography, force, duration, and latency, they all have the same effect on the environment—they all ring that bell.

(Note that response function is *not* an example of response dimension. For example, the function of the response ringing the bell might be to bring someone to the door. And that functional response has various dimensions, such as force and duration.)

It often helps to do task analyses to define responses according to their dimensions. But it is usually more convenient to define them according to their function—their product. For example, you might define children's lunchroom behavior as too noisy if it makes a sound meter go past a certain limit. Then you need not deal with the details of the response dimensions, and you can arrange for computer-like equipment that automatically punishes noisy behavior, possibly using a negative punishment contingency.

QUESTIONS

1. Define and give an example of the following concepts:
    a. response dimension
    b. response duration
    c. response latency
    d. response topography
2. Give an example of responses that vary across the following dimensions:
    a. topography
    b. force
    c. duration
    d. latency
3. Give an example of responses that differ along various dimensions but have the same function.

* If you needed to be more precise, you might say that each component of the serving skill was a separate dimension.

Example of Differential Reinforcement of Incompatible Behavior Infant Care

PARENT BLAMING[2] (G-14)

People working with children with autism often blame the parents when the child tantrums in the classroom. And, it may be true that the child originally acquired tantruming behavior because of reinforcement contingencies in the home. But if the tantruming continues in the classroom, it's because someone is reinforcing it in the classroom. If you reinforce Rudolph the Rat's lever pressing when the light above the lever is on and extinguish it when the light's off, Rudolph will stop pressing the lever when the light's off. So you can be sure that even if the parents are still reinforcing the child's tantruming at home, if you stop reinforcing the tantruming at school, it will stop . . . ah . . . eventually.

But, if eventually seems too long, you might try *differential reinforcement of incompatible behavior* (*DRI*), as Barb Etzel and Jack Gewirtz did. And they succeeded under more extreme conditions than you're likely to work with. The children were not 4-year-old kids, but two babies, 6-week-old Tony and 20-week-old Bill, both heavy-duty criers. And the two different settings were not as discriminably different as the child's home and your preschool, but an experimental lab and a nursery in the same children's hospital.

Like "good" caregivers the world over, the staff in the nursery gave oodles of love, attention, and comfort contingent on the babies' crying. For example, they'd sit down and hold and rock Bill when he started crying. And, in the lab, both babies continued their heavy-duty crying, Bill for nine 15-minute sessions and Tony for fifteen 15-minute sessions spread over several days; but extinction would have occurred . . . ah . . . eventually. However, instead of waiting for that eventuality, Barb reinforced the incompatible behavior of smiling. And for a reinforcer, she'd say, "Good boy," nod her head up and down, and smile in return. The results? As the smiles went from near zero to over one per minute, crying in the lab dropped to zero, *in spite of the reinforcement for crying that continued in the nursery*. Moral: Don't blame the parents, just get down to business with extinction and differential reinforcement of incompatible behavior. (We'll go into DRI a little more deeply in Chapter 22.)

Definition: CONCEPT

Differential reinforcement of incompatible behavior (DRI)

- Reinforcement is contingent on a behavior that is
- incompatible with another behavior.

QUESTIONS

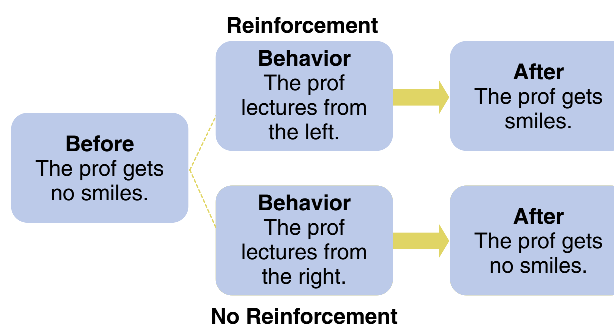
1. Give an example of parent blaming.
2. Explain why parent blaming may be incompatible with the concept of stimulus discrimination.
3. Define and give an example of the use of *differential reinforcement of incompatible behavior*.

In the Skinner Box
Experimental Analysis of Behavior

DIFFERENTIAL REINFORCEMENT

Back to Rudolph the Rat in the Skinner box, this time, to check out differential reinforcement. We'll work with the response dimension of topography and measure it in terms of the distance Rudolph presses the lever. We'll reinforce with a drop of water the class of responses that presses the lever 1 inch or more, and we'll extinguish the class of responses that presses the lever less than that 1 inch.

Differential Reinforcement



Here's what happens: At first most of the bar presses go less than 1 inch; we extinguish them. But now and then, one meets our 1-inch criterion, and we reinforce it. Gradually, the substandard presses decrease in frequency, and the acceptable ones increase in frequency. After a while, Rudolph usually presses the bar 1 inch or more and only occasionally slips in a substandard press. That's response differentiation.

What would happen if we stopped differential reinforcement and went back to a lower criterion? What would happen if we reinforced any bar press, even one that moved the bar only a hair's breadth? Over time, the frequency of 1-inch presses would decrease, and the frequency of very slight presses would increase. After a while, most of the presses would be way short of 1 inch.

QUESTION

1. Please describe and diagram an animal experiment using differential reinforcement to increase the percentage of bar presses that are greater than 1 inch.

Concept

RESPONSE CLASSES (B-1)

Notice that we allow Rudolph a little freedom. He didn't have to press the lever exactly 1 inch. He could press it 1.5 inches one time and 2 inches the next time. As long as he pressed it at least 1 inch, he got the drop of water. We defined the reinforced "response class" as being 1 inch or more.

Definition: CONCEPT

Response class

- A set of responses that
- serve the same function (produce the same outcome).

All instances of lever pressing of at least 1 inch had served a similar ***function*** (produced the same reinforcing outcome—a drop of water).

Note that, for *function*, we're talking about the effects of the response on the environment. For example, Rudolph might press the lever with his right paw, his left paw, both paws, his nose, or even his butt (different topographies). All those actions produce the same effects on the environment (serve the same function) of moving the lever down. So, in terms of that specific function (moving the lever down), they form a single response class. And, yes, we've accidentally reinforced nose presses and butt presses in our undergrad Skinner box lab. But we think later experiments work better if Rudolph only presses with both paws; and now we require our students to reinforce only those lever presses that involve both paws. So, we could now have two different response classes:

1. any response that serves the function (produces the same outcome) of moving the lever down and
2. any response that serves the function (produces the same outcome) of getting Rudy a drop of water (pressing the lever with both paws).

And what's the difference between response dimension and response class? To get the answer, we stay in the Skinner box. Two of the response dimensions of Rudolph's lever press are the duration of his press (how long he holds down the lever) and the distance of his press (how far down he presses the lever). We could reinforce Rudolph's lever presses no matter how long he holds down the lever, so duration would be a response dimension, but it would have nothing to do with whether we reinforce the lever press, that is, whether the presses are members of the reinforced response class. And the response dimension of distance could also be irrelevant. But, in our lab, the response dimension of topography helps define the reinforced response class—got to be a two-paw press.

QUESTION

1. *Response class*—define it.
2. Give an example of two responses that serve the same function (produce the same outcome, are in the same response class).

Concept

THE DIFFERENTIAL-REINFORCEMENT PROCEDURE

We've covered various forms of differential reinforcement; now let's look at the more general concept of differential reinforcement. With Rudolph, we treated one class of responses differently from other classes of responses—pressing the lever less than 1 inch, for instance. So, we used a **differential-reinforcement procedure**; we reinforced lever presses of at least 1 inch and didn't reinforce presses less than 1 inch. Of course, differential reinforcement could involve either the presentation of positive reinforcers (positive reinforcement) or the removal of negative reinforcers (negative reinforcement).

Definition: PROCEDURE

Differential reinforcement

- Reinforcing one set of responses
- and not reinforcing another set of responses.

Becoming a skilled golfer results from a long exposure to the procedure or differential reinforcement of proper swings. The new golfer hits the ball with a variety of swings. But only a particular class of swings produces reinforcers—the golf ball soaring straight toward the green and a low score. With enough differential reinforcement, this successful swing will occur a high percentage of the time. We call this ***response differentiation****—the reinforced response class occurs more frequently than the response class that is not reinforced, usually as a result of differential reinforcement*. (As we will see, differential punishment also can produce response differentiation.)*

You might have observed differential reinforcement in conversations between two people. People differentially reinforce verbal responses of each other. This is why we talk about one topic with Jack or Bill and about a different topic with our Aunt Hattie. A good conversationalist says things that others reinforce with reactions of interest or amusement.

Notice that differential reinforcement also implies differential extinction: If you're differentially reinforcing one response class, you must be differentially extinguishing the other. At least according to the universally accepted standard definition (see earlier). But that's not quite true; simply providing more powerful reinforcers for one set of responses than another would also be differential reinforcement not involving extinction.

QUESTION

1. *Differential reinforcement*—define it and give an example.

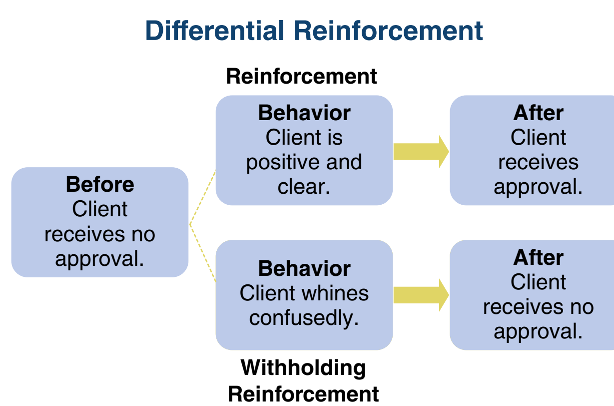
* Terminology note: Prior to the 5th edition, we defined the **differential-reinforcement procedure** as reinforcing one set of responses and extinguishing another set of responses. And frequently, that's the way it works. But one of our students pointed out that often the other set of responses has never been reinforced. Instead, what often happens is that the reinforcement of the first set of responses is also increasing the frequency of the second set of responses, even though that second set of responses has never been reinforced. But if we allow that second set of responses to continue occurring without reinforcement, the frequency of that second set will eventually decrease, as you'll see in the *Frequency Graphs* section, later in this chapter.

Example Behavior Analysis of Clinical Psychology

THE UNINTENDED USE OF DIFFERENTIAL REINFORCEMENT BY A PSYCHOTHERAPIST

A group of traditional psychotherapists, nondirective therapists, argue that the therapist shouldn't be active in the changes that come about in the therapy sessions. They say the psychotherapist should provide a sympathetic and permissive ear to the clients. And because of this gentle, kindly influence, the clients begin to understand their problems and thereby (presumably) heal themselves.

But, whether or not this therapy works, we behavior analysts don't believe that clients spontaneously begin talking in a positive way. Rather, the therapist differentially reinforces the clients' statements. The therapist's comments of appreciation, agreement, and understanding reinforce the clients' clear and optimistic statements. Extinction consists of silence and cool indifference following the clients' confused and pessimistic comments. The following dialogue shows the use of differential reinforcement in a therapy session.



Client: I just don't know how I feel about my mother. . . . The whole thing makes me depressed. . . . Like she really loves my sister more than me. . . . On the other hand, she did get a second mortgage on her home to help me go to college.

Therapist: (Sits up abruptly, leans toward the client with interest, smiles at the client slightly) Uh-huh, I guess you're saying, "My mother must love me quite a bit to have made such a sacrifice to help me through college."

Client: Yes . . . that's it. But still, every time my sister and that baby of hers visit Mother and me, Mother just can't stop playing with that little monster. She never pays attention to me when Sis and her baby are around . . .

Therapist looks out the window and glances at the clock on the wall.

Dr. Carl Rogers was the leading proponent for the nondirective view of psychotherapy. Rogers thought of the therapy session as a set of conditions that "helped" personal growth and integration. One behavior analyst, Dr. Charles Truax, decided to see if what Rogers said was true or if he did differentially reinforce positive, constructive comments of his clients without being aware of it himself.[3]

Truax listened to several recordings of Rogers's therapy sessions involving a long-term client, and he analyzed Rogers's response to each statement. He found that Rogers responded with warmth and affirmation to the client's positive comments, but he didn't reinforce confused, self-deprecating, pessimistic, or generally negative comments. He also reinforced clear comments but not unclear ones. So the positive and clear comments increased in frequency, but the negative and ambiguous ones didn't.

Truax showed that differential reinforcement determined the results of Rogers's therapy, although Rogers didn't intend to use the principles of reinforcement. At the same time, Truax confirmed that basic principles of behavior also apply in the therapy session.

QUESTION

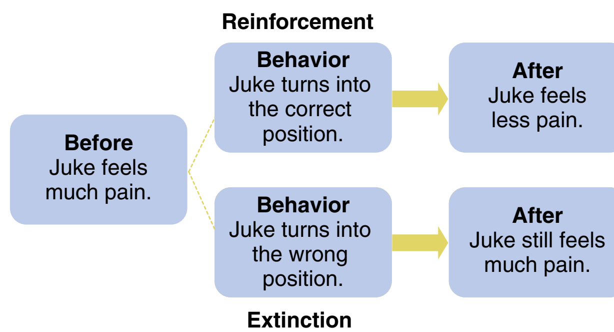
1. Describe and diagram the use of differential reinforcement in traditional, nondirective psychotherapy.

Example Everyday Life

DIFFERENTIAL NEGATIVE REINFORCEMENT

That Saturday afternoon, Juke had played his best football since his glory days at BSU, even though today it was only touch football. But now Saturday afternoon's hero had become Saturday night's victim as Juke fidgeted in bed trying to escape the pain resulting from his sedentary muscles having been so over-stressed that afternoon. Ouch! A slight turn. Ouuuuch. A slight turn in the other direction. Ouch. A . . . ah, that's it, much less pain. And throughout the night, even when he was asleep, when he rolled into a painful condition, he more and more quickly assumed the less painful position, often without even waking up—differential reinforcement of the correct lying position through negative reinforcement.

Differential Reinforcement



QUESTION

1. Diagram an example of differential negative reinforcement.

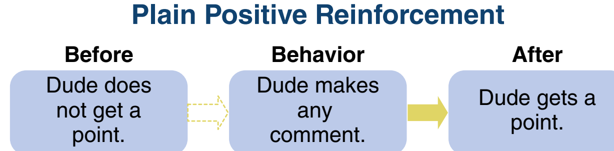
Compare and Contrast

DIFFERENTIAL REINFORCEMENT VS. REINFORCEMENT

How does the differential reinforcement discussed in this chapter differ from the regular, friendly, old, plain-vanilla reinforcement you've read about in the earlier chapters? A tough question. And the answer is that reinforcement and differential reinforcement are almost the same—almost, but not quite.

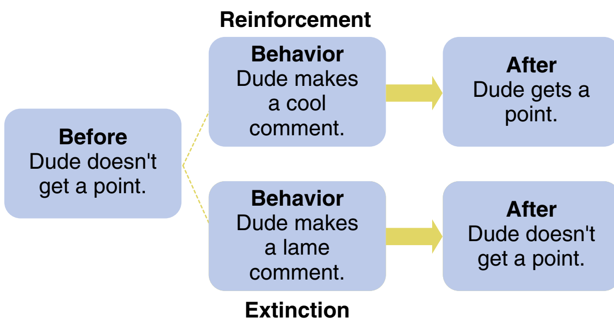
When do we use plain reinforcement? When we just want to increase the frequency of a response and don't care too much about its details. (In his seminar, Sid started out giving points for almost any off-the-wall comments his students made, just to increase the frequency of talking.)

Plain Positive Reinforcement



But we may explicitly use differential reinforcement when a large response class is occurring at a high frequency and we wish to increase the frequency of one subset of those responses and decrease the frequency of another subset. For example, after the overall frequency of commenting was high, Sid required that the comments be well thought out and that they show that the student had read the day's assignment; off-the-wall comments no longer produced points. He was trying to get response differentiation between two similar response classes: on-target comments and off-the-wall comments.

Differential Reinforcement

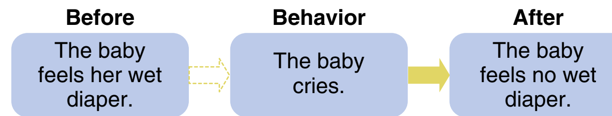


Of course, plain reinforcement always involves differential reinforcement, in some small way. (If Max doesn't speak loudly enough, Sid won't hear him and won't be able to reinforce his comments.) Differential reinforcement is always implicitly involved in reinforcement, because some responses will be reinforced and others will not. In plain reinforcement, however, the unreinforced class is defined by exclusion—any behavior that is not eligible for reinforcement. We normally analyze the contingencies only in terms of differential reinforcement when we're explicitly concerned with increasing the frequency of one response class and decreasing the frequency of another, similar response class. (If Max frequently spoke too softly to be understood, then Sid might want to differentially reinforce the class of comments that were loud and clear.)

So plain reinforcement and differential reinforcement are comparable: Both involve a reinforcement contingency that produces a high frequency of one response class. But they also contrast: We analyze the contingencies in terms of plain reinforcement when we're concerned only with increasing the frequency of one response class. And we analyze in terms of differential reinforcement when we want to increase or maintain one response class and decrease a similar response class—differential extinction might be a better label.

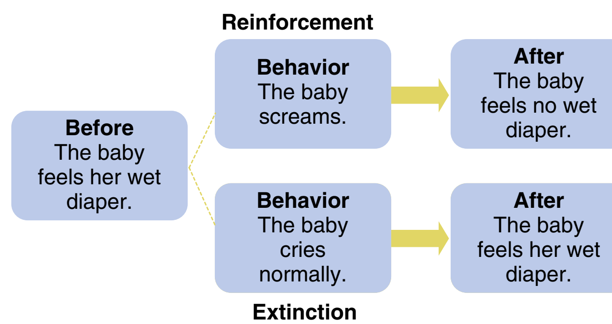
And what about reinforcement vs. differential reinforcement when both involve the removal of negative reinforcers? The baby wets its diapers, cries, and the parent changes the diapers. This is simple negative reinforcement, because almost any crying response will be reinforced.

Plain Negative Reinforcement



On the other hand, what do we have when the baby wets its diapers, cries at the top of its lungs, and the parent, listening to heavy metal on his iPod, changes the diapers? This is differential reinforcement of the class of forceful crying by negative reinforcement, because only loud cries get reinforced.

Differential Negative Reinforcement



QUESTION

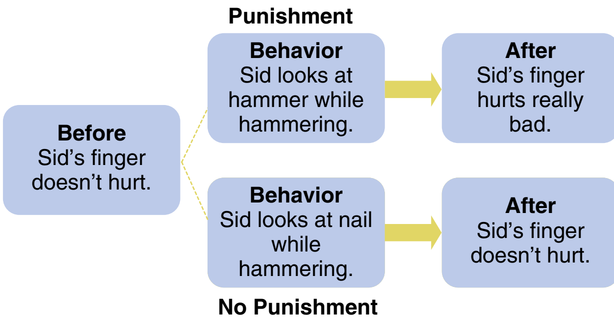
1. Compare and contrast reinforcement vs. differential reinforcement.
   - Give two pairs of examples to illustrate the difference (one pair should involve presentation of reinforcers and the other removal of negative reinforcers).

Concept

DIFFERENTIAL PUNISHMENT

Nature divides her pupils' actions into two response classes—those that slip by and those that are ***differentially punished***. Sid looks at the nail, brings his hammer down, swift, powerful, true, and the nail slides into the wooden planter with a soul-satisfying "swaaap"—a built-in reinforcement contingency. Sid looks at his hammer, brings it down, swift, powerful, false—Sid, stop! Stop! Don't do it! Look at the nail, not the hammer! Too late. "Thump." "Yeoooow!" Built-in aversive stimulation. Differential punishment of uncraftsmanlike behavior—looking at the hammer instead of the nail. Sid's response class of looking at the hammer instead of the nail will be less likely in the future.

Differential Punishment



Definition: CONCEPT

Differential punishment

- Punishing one set of responses
- and not punishing another set of responses.

Differential punishment differs only slightly from plain punishment, as differential reinforcement differs only slightly from plain reinforcement: Plain punishment and differential punishment are comparable. Both involve a punishment contingency that reduces the frequency of a response class. But they also contrast: We analyze contingencies in terms of plain punishment when we're concerned only with decreasing the frequency of one response class. And we analyze in terms of differential punishment when we want to decrease one response class and increase or maintain a similar response class.

QUESTIONS

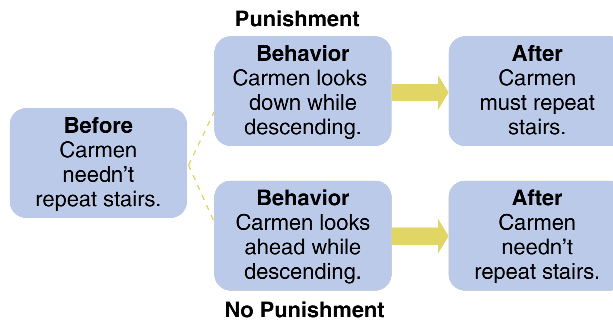
1. The *principle of differential punishment*—define it and give an example.
2. What is the difference between differential punishment and plain punishment?

In the Skinner Box
Experimental Analysis of Behavior

DIFFERENTIAL PUNISHMENT

Now, how would we show differential punishment of short lever presses? To avoid confounding our example with differential reinforcement, we could continue to reinforce all presses, no matter how slight. But, in addition, we'd punish presses that were less than 1 inch. We might use electric shock; however, the shock would have to be mild, not only for humanitarian reasons, but also so we wouldn't suppress all lever presses. So short presses would produce water plus a mild shock, and 1-inch presses would produce water with no shock.

Differential Punishment



We don't know anyone who's done this experiment, but probably the results would be much the same as with differential reinforcement: a gradual decrease in substandard presses and an increase in acceptable ones.

QUESTION

1. Please describe and diagram the use of differential punishment to decrease the frequency of a rat's lever presses that are less than 1 inch. Please explain your answer.

Example

DIFFERENTIAL REINFORCEMENT AND DIFFERENTIAL PUNISHMENT IN TEACHING CLASSICAL BALLET[4]

Madam Cupet: Ballet dancers are born, not made. They have a God-given talent.

Juke: But don't your "born" ballet dancers also get the best training? Doesn't training count, too?

Madam Cupet: In a sense, I think training does not count. If the dancer does not show signs of outstanding talent by the age of 7, she or he will never succeed, despite the amount or quality of the training.

Juke: I'm a true believer in training, Madam Cupet, but I'm just an old football player, so I've got to respect your judgment about ballet. Mae told me you yourself trained with the best teachers and danced with some of the best ballet companies in the United States, and you have an outstanding reputation as a choreographer and teacher.

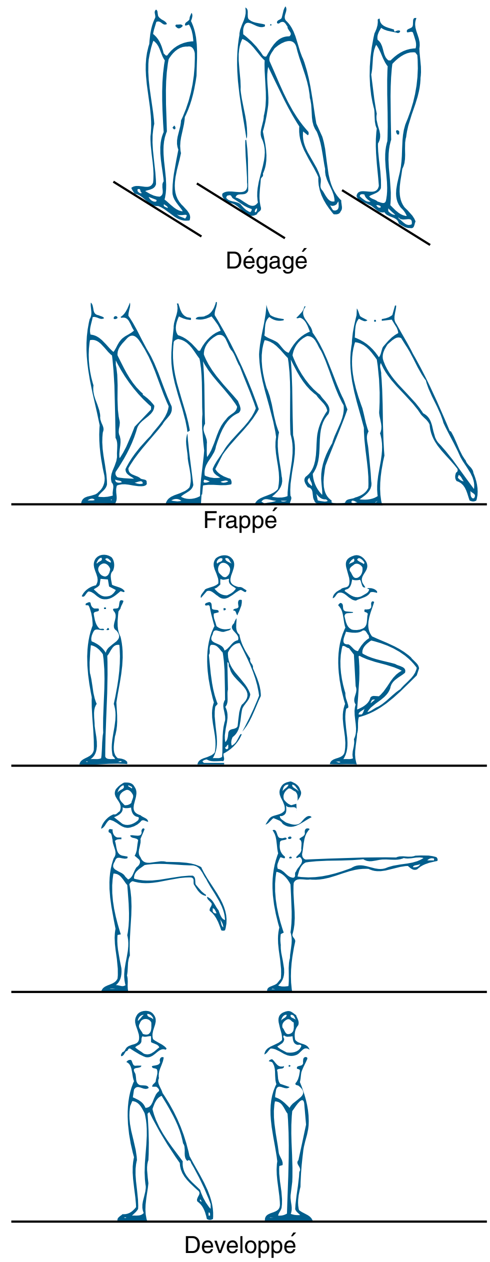
Madam Cupet: Dr. Robinson was kind. She told me you have an outstanding reputation as a trainer, and that is precisely why I am asking for your help, Mr. Jackson. I told Dr. Robinson I was going to ask Bunny Lee to withdraw from my ballet school. But this is terribly embarrassing. Her mother is my best friend. Years ago, we were in the corps de ballet together. She gave up dance when Bunny was born. And now she wants Bunny to have the career she never had. But God has not blessed the child with an ounce of talent. She is the worst student I have ever had.

After more discussion, Juke and Madam Cupet agreed to work together. Juke was a strong advocate of the training techniques Dr. Teodoro Ayllon had pioneered in sports, so he was eager to try out a procedure Ayllon and James Fitterling developed for ballet, when Fitterling was working on his master's thesis.

Madam Cupet and Juke helped Bunny with three basic ballet exercises: the dégagé, frappé, and developpé. They used the amazingly detailed task analyses Ayllon and Fitterling had done to define the correct response classes, mainly in terms of topography: weight of body on balls of feet, pelvis neither tucked in nor sticking out, hips and shoulders horizontal, heel of the front foot between first and second joint of big toe of the back foot, little toe is first part of foot to come off floor, side of big toe being the only point of contact with floor, and so on—nothing left to chance.

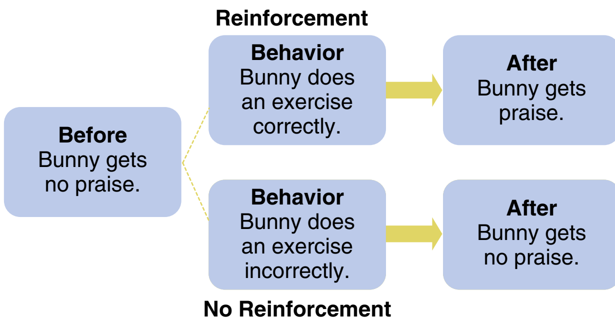
During baseline, Madam Cupet used her traditional style of instruction: lecturing and modeling the skills without music, modeling with music while counting the beats of the exercise, performance by the students, a rare praise, an occasional correction of errors, an occasional loss of temper when Bunny repeated an error, sometimes physically placing Bunny in the right position. Using videotapes, the behavior analysts later recorded the percentage of exercises Bunny performed correctly, during baseline: dégagé—33%, frappé—46%, and developpé—11%. Bunny was as terrible as Madam Cupet had said.

For the intervention, Juke instructed Madam Cupet to teach her class using behavioral coaching procedures. As in baseline, she started with instructions (a description of the relevant response class): "When the music begins, I want you to prepare in first position and then do the dégagé by moving your right foot straight back while keeping your leg straight and your body facing the front. . . ."



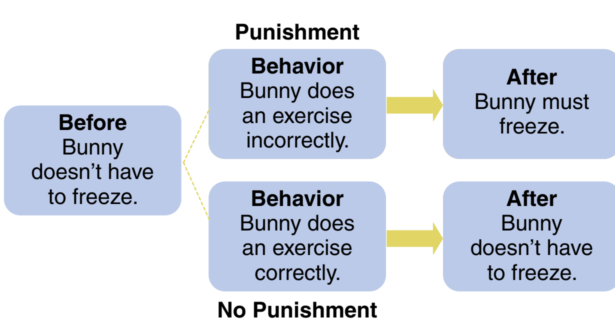
If Bunny did an exercise correctly, Madam Cupet praised her performance and commented on the correct components.

Differential Reinforcement



But each time Bunny made an error, Madam Cupet moved in with differential punishment, besides feedback, modeling, instructions, physical guidance, and more practice:
The instant Bunny made an error, Madam Cupet said, "Freeze! Don't move." While Bunny stayed in an awkward, uncomfortable, presumably aversive, frozen position, Madam Cupet pointed out her error. "You allowed your hip to follow on back with your leg; this caused you to lose much of your turn-out." Bunny remained frozen. Madam Cupet modeled the correct topography. Bunny remained frozen. Madam Cupet described the correct components missing in Bunny's performance. Bunny remained frozen. Madam Cupet physically guided Bunny from the frozen position into the correct position, in which Bunny remained frozen. Madam Cupet described those features of the response class Bunny needed to change to make the performance correct. Bunny remained frozen. "Now, you try it once." Bunny thawed out and gave it another shot. This way, Bunny always ended doing it correctly. Then Madam Cupet started the exercise sequence with music. Each correction took at least one long, painful, aversive, frozen minute—differential punishment.

Differential Punishment



The results: Behavior analysis won again—did you ever doubt it? Bunny's percentage correct improved from 33% to 92% for the dégagé (Figure 11.3), from 46% to 100% for the frappé, and from 11% to 88% for the developpé.

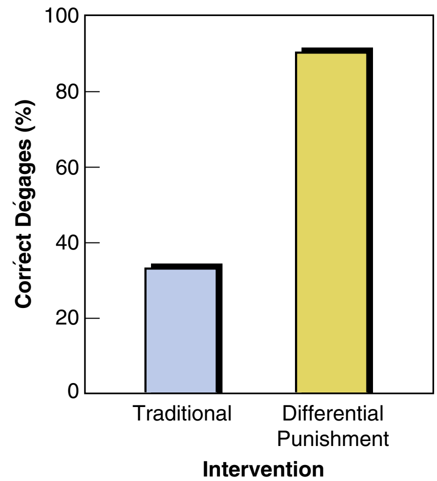


Figure 11.3 Using Differential Punishment to Improve Ballet Exercises

Bunny became nearly perfect. Never again was there any question about her withdrawing from Madam Cupet's class.

This is another example of the use of differential punishment to decrease the frequency of one set of response classes and thus increase the frequency of another. The punished response classes were incorrect performance of the three ballet exercises; the unpunished classes were the correct performances. Madam Cupet and Juke defined the response classes topographically (in terms of the movements of the dancers).

QUESTIONS

1. Describe the use of differential punishment to improve ballet skills. Include response classes, response dimension, freeze contingency, and results.
2. Explain how this is an example of response differentiation.

Ethics

USING AVERSIVE CONTROL TO SHAPE GRACEFUL MOVEMENTS

Madam Cupet: I'm concerned about this "freeze" technique. Maybe it's too aversive. Maybe it's made learning ballet too unpleasant an experience for Bunny.

Juke: True, it probably involves a mildly aversive condition.

Madam Cupet: But ballet is pure beauty, an art of perfection. It seems contradictory to teach beautiful movements with what you call "aversive control."

Juke: Maybe, but I think traditional techniques of teaching ballet may have used even more aversive techniques: When Bunny made the same error over and over, you might have said things like, "Are you deaf? What have I just said?" Now isn't that aversive control?

Madam Cupet: You make sense. My first ballet professor made me walk 10 minutes with a book on my head each time she saw me with my back bent. No other procedure worked.

Juke: But education also involves praise and other non-aversive procedures. In spite of the use of mild punishment, learning also can be fun.

QUESTION

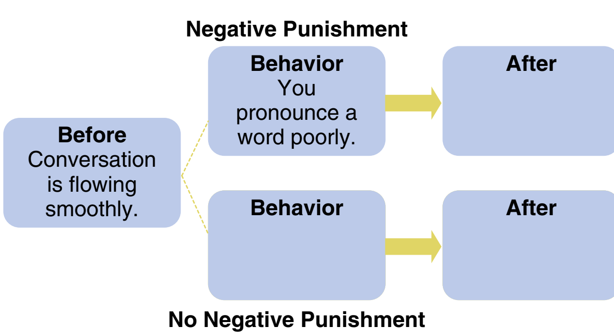
1. What is the role of aversive control in the freeze technique and traditional approaches to teaching ballet?

Differential Negative Punishment

In everyday life, the loss of reinforcers differentially punishes much of our behavior—that old negative punishment contingency. Even without meaning to, our family and friends differentially punished our vocal skills when we were learning to talk. We'd pronounce a crucial word so poorly they couldn't understand it, and they'd ask us to say it again, thus disrupting the normal flow of our conversation. Probably the loss of that normal flow would act as a punishing loss of a reinforcer—a loss that would decrease the likelihood of our poor pronunciation in the future. (Note that this is different from extinction. In extinction, the parents simply wouldn't respond to our poorly pronounced words.)

Please complete the diagram for this differential negative punishment:

Differential Negative Punishment

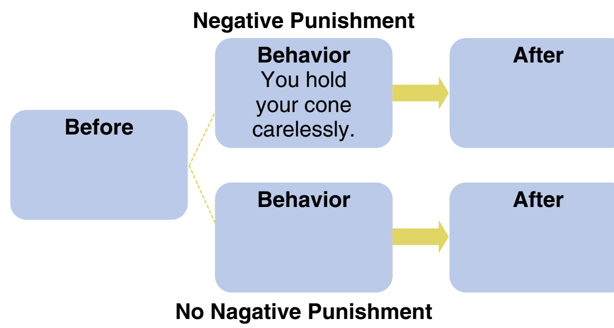


When we talk about a topic others find boring (e.g., our dreams), we may lose the attention of our audience. This might be a negative punishment contingency that will cause us to spend less time talking about our dreams in the future.

And how often did the ice cream have to topple off your ice-cream cones before the loss of that reinforcer suppressed your excitedly waving the arm that held the hand that held the cone that held the reinforcer. Such differential negative punishment contingencies caused you to acquire the skill of holding on to your precious treasures with the greatest care.

Please complete the diagram for differential punishment of poor ice-cream-cone holding:

Differential Negative Punishment



Thank you, Mr. Differential Punishment, for helping us acquire our skilled repertoires. If the loss of reinforcers didn't punish the offending acts, we'd be in a heck of a mess—no ice cream, no friends, no term papers written, not much of anything.

QUESTION

1. Give an example of differential punishment involving a negative punishment contingency. Include the response, the presumed reinforcer, the contingency, and the expected results.

Example of Differential Reinforcement Behavioral Special Education

JIMMY, THE CHILD WITH AUTISM—PART IX

"It's fun to be back at school, even if they are only night classes," said Amy Lewis. "Big State University sure has changed in the 10 years since I've been there."

"I'm so happy that you've taken such an interest in behavior analysis," said Kate. "Behavior analysis has helped me as a professional and even in my own personal life. And I'm sure Jimmy will benefit a lot from the skills you are picking up in class."

"I think so too," Amy said. "In fact, we learned about the **differential-reinforcement procedure** the other day, and I think I've got a solution to one of the problems we've been having with Jimmy."

Back in Chapter 10, we read how Jimmy would bother his mom when she was on the phone talking to someone else. He got so good at being a nuisance that Amy would cave in and give him a Snickers each time he started disrupting. She was reinforcing his pestering, and at the same time he was reinforcing her escape behavior by quieting down after getting the Snickers. Kate noticed this sick social cycle and suggested that Amy try to ignore her son's pestering.

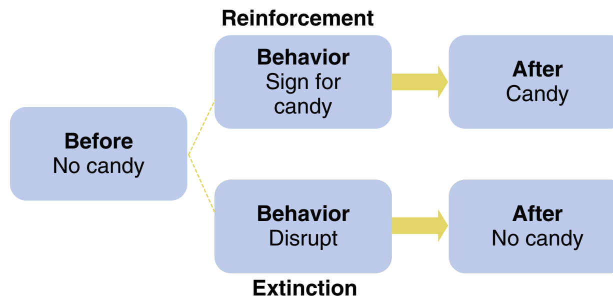
"I've been having trouble ignoring Jimmy's pestering," Amy said. "Like the other day, I was on the phone with the insurance company, and I was finally talking to a real person when Jimmy came up to me. After waiting so long to talk to someone other than a recording, there was no way I was going to let Jimmy interrupt me. And I knew that if I tried to ignore him, he would throw a fit, and I wouldn't be able to hear the insurance rep. So I gave in right away, even though I hated to do it. That's happened a few times over the past couple weeks."

"I totally understand, Amy," Kate said. "Extinction can be so hard to implement faithfully."

"But in class, I think I realized what could help," Amy said. "We could use differential reinforcement to teach Jimmy a less disruptive way to ask for attention or a treat while I am on the phone. If I can teach him a better way to get the same thing, that should help get rid of the inappropriate behavior."

Earlier in this chapter, we read about Sue and Mae using differential negative reinforcement with Jimmy. Amy would be using a similar setup at home, except this time it was for behavior maintained by positive reinforcement. First, they picked a behavior that could be in the same **response class** functionally but would have a much different **response topography**. Because Amy would be on the phone, they wanted to pick a behavior that Jimmy could do quietly but would still get Mom's attention. Kate had a little experience with sign language, so they decided to give that a shot. The behavior they wanted to teach was Jimmy's tapping his mom (lightly) on the arm, and once she was looking at him, he would hold his finger up to his cheek and rotate his hand—the sign for candy. Now they would probably have to do a **task analysis** of that complicated behavior and do a little shaping (see Chapter 18) in order to teach it, but with a budding behavior analyst available at all times, hopes were high. The new contingency would look like this.

Differential Reinforcement



QUESTION

1. Describe a differential reinforcement procedure used to decrease a child's disruptive behaviors.
   a. What behavior is reinforced?
   b. What behavior is extinguished?
   c. What should happen to the frequency of the disruptive behavior?

Research Methods

FREQUENCY GRAPHS (G-21)

Let's go back to the experiment on differential reinforcement with Rudolph. Suppose you measured the distance of each bar press and then plotted some graphs. You might do it like this: Say you start recording the distances before you begin differential reinforcement. Perhaps the first press is 0.1 inch. You'd write 0.1 in your data log. The next is 0.6. The next 1.1. Then another 0.6. The first part of your data log would look like this:

Data Log for Differential Reinforcement

Response	Distance (inches)
1	0.1
2	0.6
3	1.1
4	0.6
5	0.8
6	1.1
7	0.6
etc.	etc.

Now suppose you made a table showing the number of times Rudolph pressed each distance. The number of times means the same thing as the frequency of times, so we call it a frequency table. It would look like this for the first several responses.

Frequency Table Before Differential Reinforcement

Distance (inches)	Frequency
0.1	1
0.2	0
0.3	0
0.4	0
0.5	0
0.6	3
0.7	0
0.8	1
0.9	0
1	0
1.1	2
1.2	0

A frequency graph based on this frequency table would look like Figure 11.4. All the lever presses represented in this graph would be reinforced whether they were longer or shorter than 1 inch. But after you start reinforcing the 1-inch lever presses, only those to the right of the dashed vertical line will be reinforced.

Figure 11.5 is what the frequency graph might look like if you recorded a few more lever presses before you started differentially reinforcing 1-inch lever presses.

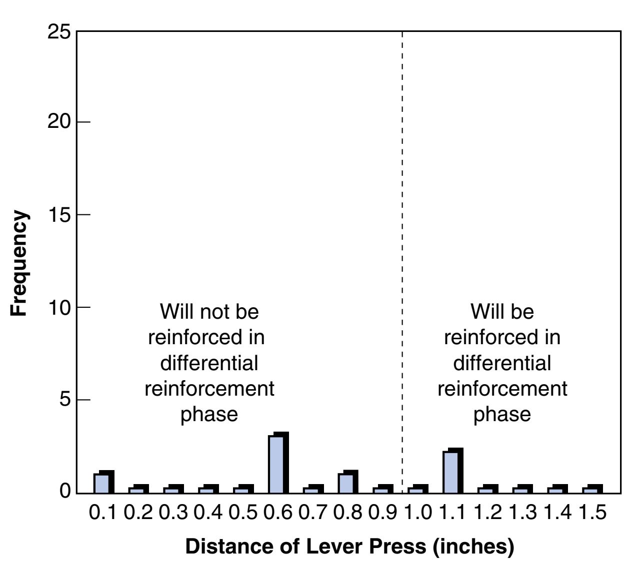


Figure 11.4 Frequency Graph Before Differential Reinforcement (a few responses)

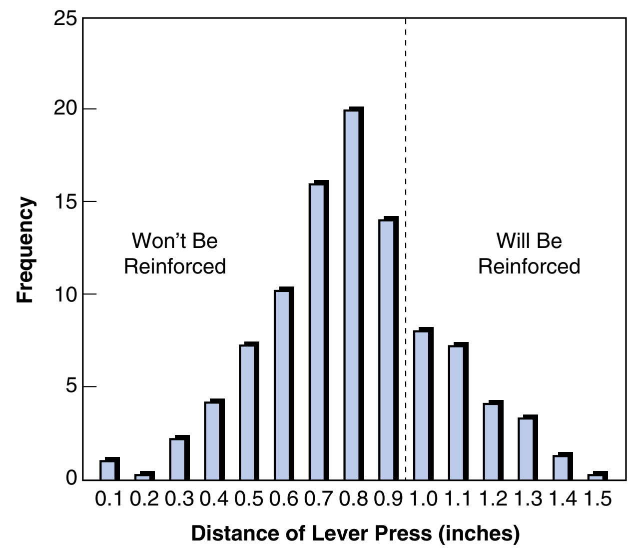


Figure 11.5 Frequency Graph Before Differential Reinforcement (many responses)

Notice that most of the distances are less than 1 inch. Why should Rudolph press the lever any further than he has to? But also notice that Rudolph isn't perfect; the distance he presses varies quite a bit from response to response. In fact, many times he does press the lever more than 1 inch. And that's good news for you. That means you'll have something to reinforce when you start trying to differentially reinforce lever presses of a distance of 1 inch or more.

If Rudolph were a precision lever-pressing machine and always pressed the lever exactly 1 inch, you'd be in big trouble. You'd have nothing to reinforce when you started your differential-reinforcement procedure.

Figure 11.6 shows how the frequencies might look after you've differentially reinforced the 1-inch bar press for a few sessions, or even after a few months; this is more or less the level of Rudolph's final performance.

Notice that you've managed to shift the majority of Rudolph's lever presses to the right of the vertical dashed line. Now the majority are presses of at least 1 inch. You can also see that the frequency of presses at each distance increases until it hits a maximum of 24 presses at the 1-inch distance. Then the frequency of presses decreases as the distance of the press gets greater and greater. Usually Rudolph doesn't press a much greater distance than needed for that response to get reinforced; of course, all response above 1 inch get reinforced. But why does he still press fairly frequently for distances less than 1 inch, even though those responses never get reinforced? Presumably, for Rudolph those shorter presses appear or feel so similar to the 1-inch presses that reinforcing

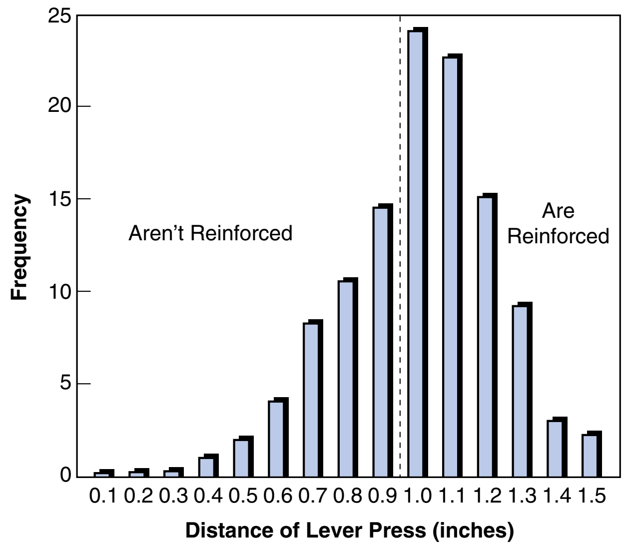


Figure 11.6 Frequency Graph After Differential Reinforcement

1-inch presses also reinforces the shorter presses, at least to some extent. This is called *response induction (or response generalization)*—reinforcing or punishing one response along a dimension (such as distance of the lever press) also increases or decreases the frequency of other responses along that dimension, even though those other responses won't produce the reinforcer or punisher. However, there's a gradient of response induction; the more similar the non-reinforced responses are to the reinforced response, the more their frequency will increase. For example, the 0.8-inch lever press occurs much more frequently than the 0.4-inch lever press. (More on the terminology of *response induction* vs. *response generalization* in Chapter 23.)

QUESTION

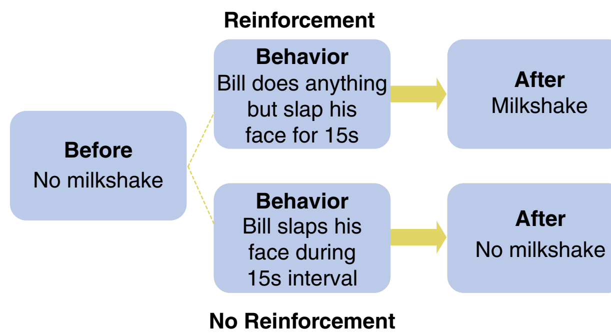
1. Prepare a frequency table and then draw a frequency graph for the following data (the grams of force with which Rudolph pressed the lever): 1, 5, 2, 5, 4, 2, 5, 2, 3, 2, 4, and 3. Be sure to include the label for the *x*-axis and the *y*-axis; and be sure to include the values along each axis, just like in the preceding graphs.

Example of Differential Reinforcement of Other Behavior (DRO)

BILL'S FACE SLAPPING[5]

Bill was an adolescent with a profound mental disability who had been living in a state institution for over 10 years. He slapped his own face so hard and so often that his cheeks were usually red and bruised. Behavior analyst Henry Corte began a series of 15-minute behavior-analysis sessions. During these sessions, Henry would give Bill a spoonful of a thick malted milkshake every 15 seconds. But Henry would provide the milkshake only if Bill had not slapped his face during that 15-second interval. If he had slapped his face, then Henry would wait 45 seconds before giving him another spoonful.*

Differential Reinforcement of Other Behavior (DRO)



Definition: CONCEPT

> **Differential Reinforcement of Other Behavior (DRO)**
>
> - A reinforcer is presented after a fixed interval of time
> - if the response of interest has ***not*** occurred during that interval.

So what kind of contingency was Henry using? As long as Bill was cool, he would get a spoonful of shake (a reinforcer) every 15 seconds. But if he slapped his face, he wouldn't get that shake reinforcer for another 45 seconds. So Henry was reinforcing any behavior *other than face slapping*. More specifically, he was using **differential reinforcement of other behavior**. How well did it work? The slaps decreased rapidly from 20 responses per 15-minute session during baseline to 0 responses during the punishment contingency (Figure 11.7).

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* I know about 10% of you are going to ask about this, so here it is: Slaps during the first 30 seconds of that 45-second interval had no effect on the presentation of the spoonful of milkshake. But a slap during the last 15 seconds of that interval prevented the presentation of the milkshake and put Bill back into another 45-second cycle. (Sorry for that extra complexity, but you know somebody would have asked if we hadn't mentioned it first.)

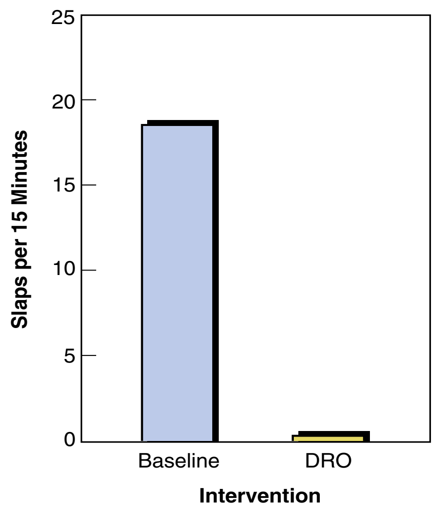


Figure 11.7 Differential Reinforcement of Behavior Other than Face Slapping

QUESTION

1. *Differential reinforcement of other behavior*
   a. Define it.
   b. Diagram its use to reduce face slapping.

In the Skinner Box

DIFFERENTIAL REINFORCEMENT OF OTHER BEHAVIOR

We don't know of any experiments on DRO in the Skinner box, but this might do the trick. If you've worked with Rudolph, you've probably noticed that, from time to time, he stops pressing the lever and starts grooming himself. Let's say you want to decrease these grooming behaviors (at least while he's in the Skinner box). So you provide him a pellet of food every 5 seconds when he is doing anything *other than grooming*.

Differential Reinforcement of Other Behavior (DRO) in the Skinner Box
Reinforcement
No reinforcement

After some time with this DRO, we would expect to see Rudolph grooming himself less frequently. (By the way, notice that we're giving him a food pellet every five seconds, not every five minutes, because of the 60-second rule.)

QUESTION

1. Diagram the procedure DRO in the Skinner box.

Controversy Compare and Contrast

DIFFERENTIAL REINFORCEMENT OF OTHER BEHAVIOR (DRO) VS. PUNISHMENT BY PREVENTION

Okay, you might be feeling a little weird about our analysis of DRO. Don't worry, we feel weird about it too. We wanted to first present the traditional analysis used to explain what's going on, but now let's talk about what we think is really happening.

Remember Bill, the young man with profound mental impairment? He slapped his face so hard his cheeks were usually red and swollen. Again, let's describe the procedure Henry Corte used to reduce this problem, but this time let's do it from the point of view of punishment rather than reinforcement.

Henry would give Bill a spoonful of a malted milkshake every time 15 seconds passed and Bill had not slapped his face. Traditionally, behavior analysts call this contingency differential reinforcement of other behavior (DRO). In other words, Henry reinforced all behavior other than face slapping—Henry differentially reinforced non-face-slapping behavior. Sounds like we're reinforcing a non-behavior, and that fails the dead-man test.

So let's roll over the dead man. Let's analyze the behavior of interest—face slapping. If Bill slaps his face, he won't get that milkshake reinforcer. And the prevention of a normally occurring reinforcer suppresses or punishes Bill's slapping. In other words, Henry was using a punishment contingency. More specifically, he was using ***punishment by the prevention of the presentation of a reinforcer*** (the milkshake).

Actual Prevention of a Reinforcer

Before	Behavior	After
Bill will receive milk shake within 15 seconds.	Bill slaps his own face.	Bill will not receive milk shake within 15 seconds.

And what about Rudolph? Let's look at the behavior of interest—grooming. If Rudolph grooms himself, he won't get the food pellet.

Actual Prevention of a Reinforcer

Before	Behavior	After
Rudolph will receive a food pellet in 5 seconds.	Rudolph grooms himself	Rudolph won't receive a food pellet in 5 seconds

Operating beneath this contingency is the ***principle of punishment by prevention of a reinforcer***: A response occurs less frequently if it has prevented a reinforcer in the past.

So this is the question: Are we equally correct in viewing this contingency as either punishment by the prevention of a reinforcer or as reinforcement of other behavior—and it doesn't matter which way? We think that's not correct; we think it does matter how you view the contingency.

Remember to keep your eye on the doughnut and not on the hole. Keep your eye on the behavior and not on the non-behavior—not the non-slapping or non-grooming. It's not really that Henry wanted to increase other behavior with this contingency. What he wanted to do was reduce Bill's slapping. And you only wanted to reduce Rudolph's grooming. We think people may lose sight of the objective when they talk about reinforcing non-behavior or other behavior. Here, the objective was to reduce the frequency of a particular response, and it was that response on which the contingency was based. In short, we think the terminology differential reinforcement of other behavior (DRO) misleads people, but many behavior analysts don't think so—in fact, your professor may not think so, and you may not think so.

We give you the analysis of DRO because the concept of DRO is so popular and the BACB wants you to know it, but we don't really think you should use the term, except when needed for communication.

And a brief word of warning: DRO (punishment by prevention of a reinforcer) doesn't work too well with nonverbal clients, because the prevented reinforcer usually would have been way more than 60" away, and the 60-second rule applies here too.

QUESTIONS

1. Diagram punishment by prevention
   a. in the Skinner box
   b. Bill's slapping his own face
2. Argue for an analysis in terms of punishment by the prevention of the presentation of a reinforcer as opposed to differential reinforcement of other behavior (DRO).

Notes

1 Based on Buzas, H. P., & Ayllon, T. (1981). Differential reinforcement in coaching tennis skills. *Behavior Modification, 5,* 372–385. The data presented are from the same article; however, the issue of team standing is fiction.

2 Based on Etzel, B. C., & Gewirtz, J. L. (1967). Experimental modification of caretaker-maintained high-rate operant crying in a 6- and a 20-week-old infant (infants tyrannoterarus): Extinction of crying with reinforcement of eye contact and smiling. *Journal of Experimental Child Psychology*, *5,* 303–317.

3 Based on Truax, C. B. (1966). Reinforcement and non-reinforcement in Rogerian psychotherapy. *Journal of Abnormal and Social Psychology*, *17*, 1–9.

4 Based on Fitterling, J. M., & Ayllon, T. (1983). Behavioral coaching in classical ballet. *Behavior Modification, 7,* 345–368. The data presented are from the same article.

5 Based on Corte, H. E., Wolf, M. M., & Locke, B. J. (1971). A comparison of procedures for eliminating self-injurious behavior of retarded adolescents. *Journal of Applied Behavior Analysis, 4,* 201–213. Figure 11.7 is based on the same article.

PART VII

Motivation

CHAPTER 12

Unconditioned and Conditioned Reinforcers and Punishers*

Behavior Analyst Certification Board 5th Edition Task List Items		
B-8.	Define and provide examples of unconditioned, conditioned, and generalized reinforcers and punishers.	Throughout
G-3.	Establish and use conditioned reinforcers.	Pages 219–221, 231–232 and throughout
G-11.	Use Skinner's analysis to teach verbal behavior.	Pages 231–232
G-17.	Use token economies.	Pages 222–226, 235–236

Concept

UNCONDITIONED REINFORCERS AND PUNISHERS (B-8)

Sid's Seminar

Sid: This chapter concerns unconditioned and conditioned reinforcers (both positive and negative) and unconditioned and conditioned punishers. And let me warn you, this may be the toughest chapter in the book; so allow plenty of time to study it.

Joe: So an unconditioned positive reinforcer must be one that doesn't need to be paired with another reinforcer. People are born with the capacity for that stimulus or event to reinforce their behavior.

Eve: Like food and water. We inherit the capacity for those substances to reinforce our behavior.

Max: And, of course, we don't inherit the capacity for $5 bills to reinforce our behavior. Five-dollar bills must be conditioned reinforcers. I suppose they become reinforcers because you can buy other reinforcers with them.

Sid: Yes, we'll read about conditioned reinforcers later in this chapter. But now, take a look at this definition of unconditioned reinforcer:

Definition: CONCEPT

Unconditioned reinforcer

- A stimulus that is a reinforcer,
- though not as a result of pairing with another reinforcer.

Sid: And this definition refers to negative reinforcers as well as positive reinforcers.

Eve: So that means an unconditioned negative reinforcer must be something that's a negative reinforcer, even though it has not been paired with another negative reinforcer.

Joe: Yeah, like the pain from touching a hot stove. We're born with the capacity for that pain to be a negative reinforcer.

Max: And the removal of that pain will reinforce pulling our hand away from the stove, a negative reinforcement contingency.

Sid: You've got it, so now take a look at the definition of an unconditioned punisher:

* In this chapter, we're going to dance around various variations of terminology. When we say *reinforcers* we may be talking about only positive reinforcers or both positive and negative reinforcers. And we'll be using *aversive stimuli* to refer to both negative reinforcers and punishers. We hope the context will make our usages clear. And we think this will be less awkward than laboriously spelling out *positive* and *negative reinforcers* when it should be implied by the simpler *reinforcer*. Same with *negative reinforcers* and *punishers* vs. the simpler *aversive stimuli*. Here's hoping.

Definition: CONCEPT

Unconditioned punisher

- A stimulus that is a punisher,
- though not as a result of pairing with another punisher.

Joe: Yeah, again, like that pain from touching the hot stove. We're born with the capacity for that pain to punish our touching the stove.

QUESTIONS

1. *Unconditioned reinforcer*—define it and give an example of an unconditioned positive reinforcer and of an unconditioned negative reinforcer.
2. *Unconditioned punisher*—define it and give an example.

THE THEORY OF DIRECT *AND* INDIRECT BIOLOGICAL RELEVANCE

Unconditioned Positive Reinforcers

Notice that food and water both provide us with direct biological benefits. For example, they are essential to the well-being of the cells of our bodies. Can you think of any unconditioned reinforcers that don't provide direct biological benefits? What about visual stimulation? If you've ever been inside a pigeon colony, you'd see that each pigeon stands facing out through the open grill of the cage door where there's more light. I've never seen a pigeon stand facing the inside of their cage, where it's dark.

Before	Behavior	After
Animal has little visual stimulation.	Animal turns toward opening.	Animal has more visual stimulation.

Sound is another example. Sound will act as a mild reinforcer for rats—it will maintain a low frequency of lever presses. Not as well as food, but better than nothing.

Neutral Stimulus	Unlearned Reinforcer
vocal sounds of parent	food, water, removal of aversive condition
no vocal sounds of parent	no food, water, removal of aversive condition

And if you've ever interacted with a baby, you've probably noticed that they will reliably orient toward the television. This is especially true during commercials or introductions to a show, when the TV produces its highest rate of audiovisual reinforcers—a new sight and sound every second.

Before	Behavior	After
Baby has little visual stimulation.	Baby turns toward TV.	Baby has much visual stimulation.

Even no-calorie sweeteners seem to be unconditioned reinforcers. Food-deprived rats will make a response that produces a saccharine solution 100% of the time in preference to plain water.[1] But saccharine is just a taste. It has no other nutritional value.

Before	Behavior	After
Rat has no sweet taste.	Rat drinks saccharine water.	Rat has sweet taste.

It makes sense that stimuli that help our body's cells should be unconditioned reinforcers, but why might sight, sound, and taste also be unconditioned reinforcers? Here's one theory: More or less all animal species (including the human species) evolved in such a manner that stimuli naturally associated with food are unconditioned reinforcers. These stimuli include sight, sound, taste, and smell. For example, suppose two animals see a slight movement or hear a slight sound, a stimulus that is naturally associated with food, like the movement of prey. Which animal would be most likely to get the food and survive: the one that orients its eyes and ears toward the sight or sound and thus can better see or hear it and thus can better pounce on it, or the one that ignores the stimulus? The visual or auditory stimuli reinforce the response of orienting in the direction of sights and sounds. And that orientation response makes it more likely the animal will be able to attack the prey and eat it. And, also, that orientation makes it more likely the animal will survive. And surviving makes it more likely the animal will pass on to its offspring the capacity for its behavior to be reinforced by those sights and sounds.

Unconditioned Negative Reinforcers

Also, some stimuli naturally associated with harm are often unconditioned negative reinforcers. For example, inexperienced baby chicks run to sheltered areas when they see a large hawk-like shadow on the ground. My interpretation is that the sight of that shadow is an unconditioned negative reinforcer, and when the chicks run under the shelter, they escape that sight;

thus, running under the shelter is reinforced. If a chick could cause the shadow to disappear by pecking a key, that escape response would also be learned.

Here's an interesting way to look at these indirect positive and negative reinforcers: The biologically important reason for orienting toward sights and sounds is that it helps animals (including us) to avoid injury and death (to survive). But that natural contingency is ineffective in controlling behavior; you're liable to be dead before you can learn the orienting response based on survival as the reinforcer.

Ineffective Natural Contingency

Before	Behavior	After
Animal less likely to survive.	Animal orients toward stimulus.	Animal more likely to survive.

So through evolution, nature has added what we might consider a performance-management contingency, one that is not important by itself, but one that has evolved because it does control behavior effectively and does help the organism avoid injury and death (helps it survive)—the original outcome of the natural but ineffective survival contingency.*

Performance-Management Contingency

Before	Behavior	After
Animal has no audio-visual reinforcer.	Animal orients toward stimulus.	Animal gets audio-visual reinforcer.

So we have two types of unconditioned reinforcers—those that directly cause biological benefits and those that indirectly cause biological benefits. And by biological benefits, we mean benefits to your body, to your body's cells. Like food and water directly benefit your body's cells. And sights, sounds, smells, and tastes only indirectly benefit your body by making it more likely you'll get the food and water that provide the direct benefits. But what about all the unhealthy foods we eat today? Why are things that are so bad for us so reinforcing? We can probably blame our ancestors for that. Sweet tastes used to be a good indication that foods were healthy, like fruits which contain lots of nutrients. But now we have processed foods and can put sugar in everything, so the sweet taste is misleading; now it rarely indicates sources of good nutrition. And maybe fatty foods like bacon would have been beneficial way back then, because the extra fat would help our ancestors live through harsh winters with just primitive shelter.

We also have two types of unconditioned aversive stimuli—those that directly cause biological harm and those that indirectly cause biological harm. Like a predator's bite or spoiled food directly harms your body's cells. And the shadow of the hawk or a loud noise or the taste and odor of spoiled food are only indirectly "harmful," in that when you experience those stimuli, your body is likely to be harmed. You can think of those indirectly harmful stimuli as really being helpful, because you escape the unconditioned negative reinforcers or they punish your approaching them; so they help keep your body healthy. Like, you escape the bad smell and bad taste of spoiled food. So you don't eat it. And then the spoiled food doesn't harm you. In other words, those unconditioned aversive stimuli can be both negative reinforcers and punishers, of course.

Remember the hand-flapping self-stimulation of Jimmy, our boy with the autistic behavior, like in Chapter 10? Is that an unconditioned reinforcer? What about your twirling your hair, or my stroking my beard? In all cases, I think our repetitive behaviors are reinforced by some sort of sensory reinforcer: auditory stimuli, tactile stimuli, proprioceptive stimuli, or kinetic stimuli. And I'd speculate that these are generally unconditioned reinforcers that must have or have had some biological value.

QUESTIONS

1. Give an example of an unconditioned positive reinforcer with a direct biological benefit.
2. Give an example of one with an indirect biological benefit.
   a. What is that indirect benefit?
3. Give an example of an unconditioned negative reinforcer with a direct biological benefit.
4. Give an example of one with an indirect biological benefit.
   a. What is that indirect benefit?
5. Give an example of an unconditioned punisher that causes direct biological harm.
6. Give an example of one that causes indirect biological harm.
   a. What is that indirect biological harm?

* Actually, this analysis should be much more complex. If visual stimuli were not unconditioned reinforcers, they would have to become conditioned reinforcers. And for that to happen they would have to function as discriminative stimuli (Chapter 14) in the presence of which "searching" for prey would be reinforced. Similarly, if visual stimuli were not unconditioned, the avoidance response (Chapter 17) would avoid the pain of an attack. I said it was complex; that's why this analysis is buried in a footnote.

Example of a Conditioned Reinforcer
Behavioral Clinical Psychology

PSYCHOTIC TALK

"Dr. Baker, the superintendent is still tryin' to get into my bed every night, but I always fight him off. I can't afford another illegitimate child," Helen said.[2]

As she talked, Helen jerked her head from side to side, throwing her uncombed brown hair over the shoulders of her faded pink print dress—her favorite dress. She had brought that old dress with her when she entered the State Psychiatric Hospital 15 years ago. It no longer properly contained her 210 pounds, but she wore it anyway, though her sister often brought new clothes on her monthly visits.

Sixty-three-year-old Helen kept talking, as she sat on the patient's side of the ancient oak desk in the psychology consulting room of Big State Hospital. Dawn sat on the other side. Helen fidgeted about in her chair, while talking. Dawn remained quiet, staring out the window.

When Helen paused for a few seconds, Dawn asked, "So, what activities did you take part in yesterday?" As Helen rambled on, Dawn devised an intervention she hoped would help Helen reduce her psychotic talk.

The next day at the staff meeting, Dawn said, "Let me propose a program for Helen."

One of the psychiatric nurses replied, "I hope you've got something powerful, because Helen's getting into serious trouble. She's under the delusion that men are chasing her and that she has an illegitimate child. She bothers the other residents with her constant talk about the men and her child; they've even started beating her up to stop her talking. We try to protect her, but we don't always get there in time."

The head nurse said, "I doubt if you can do much. She's suffered from these delusions for the last 3 years, and we've done everything we can to help her. I'm afraid she has nothing else to talk about."

The psychiatrist said, "Helen is delusional. She has a distorted perception of reality based on her inner conflicts. She feels she must express her troubles to someone else to get free. Her problems are symptoms of deep-rooted psychic disorders."

As her colleagues talked, Dawn thought, *No, her problems are not symptoms of deep-rooted psychic disorders; they're the result of an unfortunate behavioral history. Her problems are not psychic excrement squeezed out of her mental toothpaste tube by the firm grip of irresistible psychic forces. Your mentalistic diagnoses sound impressive, yet they haven't helped Helen much*. Aloud, she said, "I'd like you to consider an alternate view, one that may not be easy to understand; but bear with me. Suppose Helen's psychotic, delusional talk is just like any other class of complex, learned responses. Suppose she has learned the response class of delusional speech because it has produced reinforcers. Then perhaps we can use the principles of reinforcement to deal with the problem."

"That doesn't make much sense to me, Dr. Baker," the psychiatrist said. "What could possibly be reinforcing her delusional speech? I don't think anyone's going around putting M&Ms in her mouth every time she experiences one of her delusions."

"Yes, Dr. Jones," Dawn replied, "I'm sure no one is giving her M&Ms. But many of the reinforcers that control our behavior are not unconditioned, innate biological reinforcers; they're not like the sweet taste of candy. So when we look for obvious unconditioned reinforcers, we often miss the subtler *conditioned reinforcers*—the ones really maintaining the behavior."

"Like what?" Jones asked.

"Well, some of the most powerful conditioned reinforcers are social reinforcers—reinforcers provided by other people—such as approval and sometimes simply attention," Dawn answered.

"But surely no one approves of her delusional speech," the psychiatrist said. "Instead, we criticize her for it."

"I know it sounds strange, but sometimes even negative attention is more reinforcing than no attention. This is common in large institutions, where there's not enough staff to interact adequately with the residents. One of the best ways to get attention in such a place is to act bizarrely. Then the staff, or other residents, or visitors will pay attention to you. Even when our attention is in the form of criticism, we often unintentionally reinforce that bizarre behavior."

"That makes some sense to me," a psychiatric nurse said. "But we need to talk to her when she's having her delusions. We need to reassure her and bring her back to reality."

"I know what you mean," Dawn said. "But that puts us in a bind, because warm, gentle reassuring talk is most likely a powerful reinforcer. So in our efforts to get Helen out of her delusions, we may unintentionally reinforce those same delusional behaviors—we may make future delusions more frequent."

"I often don't have time to talk to her in detail," another psychiatric nurse said, "but I at least nod and say something like 'Yes, I understand.' It seems so rude to ignore her."

"Yes, it seems awkward to ignore people, but often, when they're behaving inappropriately, that would be best for them," Dawn said.

"Do you mean we should ignore her for the rest of the day, whenever she has a delusion? That seems too cruel."

"I agree," Dawn said. "We should ignore her only while she's talking in a delusional way. We should go out of our way to pay attention to her when she's talking in a normal way. That way we're extinguishing inappropriate behavior and reinforcing appropriate behavior."

"I'm skeptical that such a superficial approach is going to achieve anything, but I'm willing to try it," Jones said.

"I don't blame you for being skeptical, Dr. Jones," Dawn said. "One of the reasons I have some confidence in this intervention is that it's the same one Ayllon and Michael used with a similar case way back in 1959. It worked then, so it should work now. I appreciate your willingness to try it, so we can find out."

The Intervention

During the intervention, the nurses would check Helen every half hour. They would ignore her if she were talking in a psychotic manner but would pay attention to her if she were talking normally. In the week before the intervention, 91% of Helen's talk was psychotic. By the end of the first 9 weeks of intervention, her psychotic talk dropped to less than 25% (Figure 12.1). This was a dramatic change, especially considering the complex nature of the response class and its high frequency of occurrence for at least 3 years.

During the last 3 weeks of the intervention, some unforeseen bootleg ("illegal") reinforcement interfered with Helen's

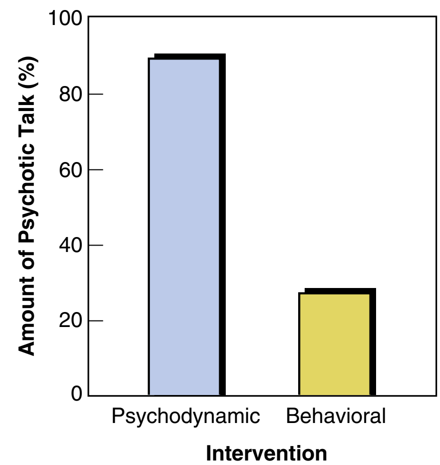


Figure 12.1 Differential Reinforcement of Normal Talk for a Woman in a Psychiatric Ward

progress. In the 10th week, Helen talked to a traditional social worker who reinforced the psychotic talk. As Helen told a nurse, "Well, you're not listening to me. I'll have to see Miss Johnson again because she told me she could help me if I talked about my past."

It looks like attention was a strong reinforcer. Attention increased the psychotic talk in the presence of the social worker, and attention also increased such talk on the ward when the social worker was absent. The psychotic talk doubled to become about 50% of her total talk. Other sources of unauthorized reinforcement occurred when a volunteer ladies' organization came to entertain the residents and also when an institution employee came to visit the ward. In both cases, the visitors reinforced the psychotic talk by paying attention to Helen when she talked that way. After this bootleg reinforcement, it took several weeks before the staff was able to get Helen's frequency of psychotic talk back down to its lower level. To maintain their extinction program, they had to exert extreme care in getting the cooperation of everyone who interacted with Helen.

When Ted Ayllon and Jack Michael did the real study on which we based our story, most of the work you read in this book had not been done. It took intellectually independent people with much imagination to think of psychotic talk as reinforced behavior. It also took courage to test a technique for extinguishing this psychotic talk, especially because no one had tried it before.

Incidentally, as we are becoming painfully aware, not all talk of sexual abuse by inmates is psychotic.

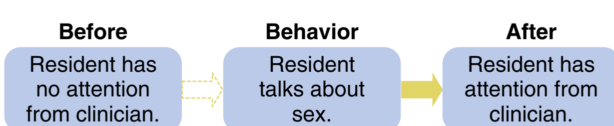
QUESTIONS

1. What are some mentalistic interpretations of the causes of psychotic talk?
2. What are some objections to a behavioral analysis and intervention for psychotic talk?
3. Diagram the use of differential reinforcement to reduce psychotic talk.
4. What happened when Helen's psychotic talk got bootleg reinforcement after a few weeks of the extinction procedure?

Psychotic Talk—Sexual Disorders May Be in the Ear of the Beholder

A little more on Helen's talk about her illegitimate children and the men pursuing her. Such talk is typical of the sexual emphasis in the bizarre talk of residents with behavioral problems. Traditional clinical psychologists think this reveals the residents' sexual disorders. However, an analysis of psychotic talk in terms of reinforcement suggests a different picture. Residents with behavioral problems, like anyone else, will make any reinforced response in their repertoire. If the traditional clinicians pay special attention to talk with sexual overtones, this attention will reinforce that type of talk, and the sexual talk will occur more often.

Unintentional Reinforcement Contingency



If "deep-seated" sexual disorders exist, they may not be in the resident with the behavioral problems but rather in . . .

QUESTION

1. Residents of psychiatric institutions often have a high frequency of bizarre talk with a sexual emphasis. Diagram a behavioral interpretation of this phenomenon.

Concept

HOW ARE CONDITIONED REINFORCERS CONDITIONED? (B-8) (G-3)

Remember the definition of ***unconditioned reinforcer***: *a stimulus that is a reinforcer, though not as a result of pairing with another reinforcer*. So it won't take too much imagination to guess the definition of a ***conditioned reinforcer***:

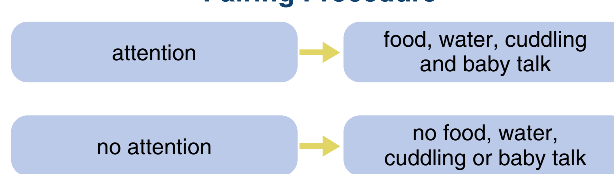
Definition: CONCEPT

Conditioned reinforcer (secondary reinforcer)

- A stimulus that is a reinforcer
- because it has been paired with another reinforcer.

Attention may be a good example. We've suggested that attention was a powerful conditioned reinforcer for Helen. If attention were a conditioned reinforcer, that would mean it hadn't always been a reinforcer for Helen. Helen was not born with attention acting as a reinforcer for her behavior. Instead, only through learning did attention become a reinforcer for Helen's behavior. Attention became a conditioned reinforcer because it was often paired with other reinforcers when she was a baby. What are some other reinforcers normally available to Helen the baby, only if she had someone's attention? Food. Water. Cuddling. Baby talk.

Pairing Procedure



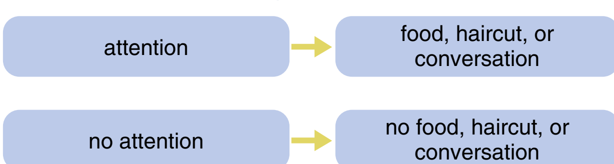
Again, Helen was not born with attention functioning as a reinforcer. It took many pairings of attention with other reinforcers for attention to become a reinforcer. Once attention becomes a conditioned reinforcer, it functions just like an unconditioned reinforcer. It increases the frequency of any behavior it immediately follows. The following reinforcement contingency shows how smiling can be reinforced by attention. If the behavior did not increase in future frequency, attention would not have been functioning as a reinforcer.

Reinforcement

Before we go on, please take another look at the pairing procedure diagram. Note that the pairing procedure actually involves two pairings: The top pairing is the pairing of attention with food, etc. But for that to be meaningful, we must also have the bottom pairing—the pairing of no attention with no food, etc. (or at least the food, etc., is not as probable when there is no attention). In other words, if we pair a neutral stimulus with an original reinforcer, logically that means that the absence of that stimulus is paired with the absence of that reinforcer. Please keep this in mind when you generate your own examples of the pairing procedure or deal with them on quizzes. But now back to Helen.

What about Helen the adult? Even an adult must have someone's attention before getting food in a restaurant, a new 'do at the salon, or conversation at home. Typically, attention is initially paired with unconditioned reinforcers like food, water, and comfort; after it becomes a conditioned reinforcer, to some extent it is maintained as a conditioned reinforcer by being paired with other conditioned reinforcers like conversation or a haircut. In fact, generally, it's possible to establish conditioned reinforcers just by pairing them with other conditioned reinforcers.

Pairing Procedure



We are all such social animals that attention is paired with many of our most important reinforcers from the day we're born until the day we die. Attention is a powerful but sneaky reinforcer; it often controls our behavior without our knowing it. What do you think is a hidden reinforcer that controls your professor's lecturing? If you're not sure, try falling asleep. What reinforces telling a joke? Try walking away in the middle of someone's joke to find out.

Often social approval goes hand in hand with attention, but not always, as in Helen's case, in which attention maintained inappropriate behavior in spite of the disapproval. In some circles, belching and flatulence produce reinforcing attention, though not approval. (If you don't know what flatulence means, find out more than you'd care to know at UrbanDictionary.com.) Do you know people, other than your professors, who run in such circles?

Incidentally, it's not clear how immediate the pairing should be between the neutral stimulus and the reinforcer. We assume within a few seconds. Maybe no more than a fraction of a second should elapse between the presentation of the neutral stimulus and the reinforcer. It also may be that the onset of the neutral stimulus should slightly precede the onset of the reinforcer. But the main point is that probably no professional behavior analyst would expect to establish a conditioned reinforcer if, say, an hour, or even several minutes, elapsed between the neutral stimulus and the reinforcer. We'll call this pairing of a neutral stimulus and a reinforcer or punisher the **pairing procedure**,* and we'll describe the results in terms of the **value-altering principle**.**

Definition: PROCEDURE

Pairing procedure

- The pairing of a neutral stimulus with
- a reinforcer or punisher.

Definition: PRINCIPLE

Value-altering principle

- The pairing procedure
- converts a neutral stimulus into
- a conditioned reinforcer or conditioned punisher.

Note that, although we don't include *immediate* in the definition of *pairing procedure*, probably the two stimuli need to be paired within a few seconds of each other, and ideally

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* Many behavior analysts assume that this type of pairing is the same as the pairing in respondent conditioning; however, I'm not so sure that's true. In Chapter 1, you learned about respondent conditioning. To learn more about the difference between respondent and operant conditioning, check out DickMalott.com.

** We introduced the pairing procedure concept and value-altering principle in the 3rd edition of *Elementary Principles of Behavior*, because we found that students were not focusing adequately on how conditioned reinforcers and conditioned punishers are acquired.

within a fraction of a second. For example, suppose you were working with a child with autism, and you were trying to create a conditioned reinforcer out of the statement *good job* by pairing *good job* with other reinforcers such as little bites of favorite foods. You sure as heck wouldn't want to say *good job* and then give her the bite of food an hour later; you'd be doomed to failure. A delay of no more than a fraction of a second would come much nearer to doing the trick.

In summary, a neutral stimulus (event, activity, or condition) becomes a conditioned reinforcer when it has been paired with an original reinforcer. This original reinforcer could be an unconditioned reinforcer. But the original reinforcer itself might also be a conditioned reinforcer that had previously acquired its reinforcing value through pairing with some third reinforcer. Same goes with converting neutral stimuli to conditioned punishers.

QUESTIONS

1. *Conditioned reinforcer*—define it and give a couple of examples and show how they might have acquired their reinforcing value.
2. *Pairing procedure*—define it.
3. *Value-altering principle*—define it.

Example of the Pairing Procedure and Conditioned Reinforcers Behavioral Special Education

JIMMY, THE CHILD WITH AUTISM—PART X

Socializing Jimmy

Jimmy has had a hard time learning the functional behaviors and the functional values kids normally have—behavior and values kids normally learn without hardly noticing that they're learning them. But Jimmy all too easily learned and got hooked on the dysfunctional behaviors and dysfunctional values most kids normally don't learn or pass through only briefly. As we've said, Jimmy's learning history was so dysfunctional that traditional psychologists have given him an autism label.

Often children with serious deficits in learned behaviors have not learned to value attention and approval; in other words, neither attention nor approval is a social reinforcer. Somehow, the normal pairing of attention and approval with other reinforcers (food, comfort, play) does not work nearly as well with a few kids as it does with most kids. And Jimmy was one of those few kids for whom the normal pairing had failed.

So what's the consequence of Jimmy's failure to learn to value attention and approval? Disaster. We human beings are such socialized animals that we hardly notice how dependent we are on the finely tuned interactions among us. For example, attention and approval are constantly shaping our children's behavior.

"Oh, look what Rod did. Isn't that cute?"

"Rod, Daddy's so proud of you!"

Or much more subtle—a glance of approval, a smile, eye contact, or even a slight turn of Dawn's head in Rod's direction—all ways of approving or paying attention. All big reinforcers for Rod and most other kids, but not for Jimmy.

Here's why we think this is so important. We think that most of what we all consider appropriate human behavior we learn from other human beings. And one of the crucial ways we learn appropriate human behavior is through social reinforcement in the form of approval and attention contingent on normal behavior.

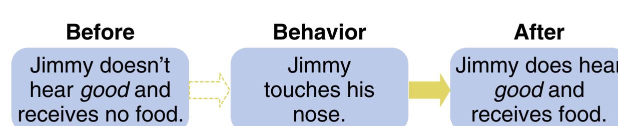
So if attention and approval aren't conditioned reinforcers for Jimmy, he won't learn to act like a typical child. That's how bad it is. He will be so different from a typical child that he will be given an autism label.

So what was one of Mae's first steps in teaching Jimmy how to function as children normally do? She and her staff did a lot of pairing of attention and approval with powerful reinforcers. Remember:

Eve: Jimmy, touch your nose.

Jimmy did.

Eve: GOOD! (And she gave the slightly hungry Jimmy a quarter spoonful of cereal and skim milk.)



A lot of learning occurred in that single, discrete learning trial. Not only would Jimmy's nose touching be more frequent when he was requested to do so, but for our present concern, *good* was being paired with the powerful unconditioned reinforcer of food. (Eve could have just worked on the pairing without requiring any responses, but by also reinforcing a response with the original reinforcer, she was making the most of her time.)

Good! → food

no Good! → no food

With enough pairings of a variety of forms of attention and approval with a variety of powerful reinforcers, attention and approval will become powerful conditioned reinforcers for Jimmy, just as they are for most of us.

Then Mae's staff will be able to use these conditioned social reinforcers as the main tool in teaching Jimmy, and eventually they will generally be able to do away with the unconditioned reinforcers such as food. That's important for two reasons: First, it will help prepare Jimmy for a regular-education classroom where social reinforcers are a major tool. And second, it will prepare him for the incidental teaching that normally takes place during a child's interaction with others, especially his parents.

QUESTION

1. Describe a procedure for establishing social approval as a reinforcer for a child with autism.

The Generalized Reinforcer
Behavioral Clinical

A TOKEN ECONOMY IN A PSYCHIATRIC WARD (G-17)

After Ted Ayllon did the pioneering work on which we based Helen's case history of psychotic talk, he got his PhD and moved to Anna State Hospital, in Anna, Illinois. There he worked with Dr. Nathan Azrin, doing the first research with token economies in teaching and maintaining normal behavior of residents in a psychiatric institution. As with Ayllon's earlier work, this research involved psychiatric residents who had been on the back wards for many years. These people were women suffering from severe problems with verbal and social behavior.[3]

The structure of the token economy on this ward is so interesting it deserves special comment. The residents earned little metal tokens by making responses useful to the residents as a group, such as serving meals, cleaning floors, sorting laundry, selling items in the commissary, projecting movies, leading guided tours, and helping the nurse. The residents also earned tokens for other behaviors such as self-grooming.

They could exchange the tokens for backup* reinforcers (the reinforcers with which the conditioned reinforcers had been paired). For example, residents with sufficient tokens (4 to 30) could pay for a particular bedroom and thus indirectly select their roommates. Residents who didn't rent a special bedroom slept in the free room. They could get a choice of eating groups (1 token) and secure locked cabinets to store their belongings (1 token). They could rent a personal chair that they didn't have to share with other residents (1 token). They also could use 1 token to rent a room divider to shield their bed. With 2 tokens, they could obtain escorted or unescorted leaves from the ward. They could exchange 100 tokens for a 1-hour escorted visit to a neighboring town. A 10-minute private meeting with a member of the staff cost from 20 to 100 tokens, and they could extend it by using additional tokens. (They didn't need tokens for the first 5 minutes of social interaction with the ward physician, nurse, and institution chaplain.) They could exchange from 1 to 10 tokens for participation in religious services of the resident's choice.

Other backup reinforcers consisted of movies, a live dance band, exclusive use of a radio or television, and attendance at institutional activities such as dances (all from 1 to 3 tokens). In addition, with tokens they could get consumable items such as extra clothing, grooming accessories, reading and writing materials, and a choice of items by special request such as potted plants and parakeets (1 to 400 tokens).

How do we establish conditioned reinforcers? We pair them with existing reinforcers. Attention probably became and continued to be a conditioned reinforcer for Helen (and for the rest of us) because it had been and continues to be paired with the receipt of many other reinforcers such as food, conversation, and service. But in the case of Ayllon and Azrin's token economy, the participants were verbal adults, so the pairing could be a verbal analog to pairing rather than direct

* In some contexts, we tend to say a neutral stimulus was paired with an *original* reinforcer or aversive condition. But when talking about tokens, we tend to say the token was paired with and exchanged for *backup* reinforcers—the reinforcers that backed up the token economy. Not a big deal.

pairing itself; the staff could establish the tokens as a sort of conditioned reinforcer simply by telling the participants they could exchange them for various backup reinforcers. Ayllon and Azrin didn't have to do direct pairing.*

The tokens Ted and Nate used in this study had a wide utility because the residents could exchange their tokens for a variety of reinforcers. We call this type of reinforcer a **generalized conditioned reinforcer**.

Definition: CONCEPT

Generalized conditioned reinforcer (generalized secondary reinforcer)**

- A conditioned reinforcer that is a reinforcer
- because it has been paired with a variety of other reinforcers.

In other words, a generalized conditioned reinforcer is a special type of conditioned reinforcer. A stimulus (event, activity, or condition) can become a conditioned reinforcer solely from pairing with a single type of backup reinforcer. But a generalized conditioned reinforcer must be paired with a variety of other types of reinforcers, like the many privileges the psychiatric residents could buy with their tokens. Normally those different backup reinforcers should be associated with different deprivations.

A conditioned reinforcer is effective only if the organism is deprived of the other reinforcers with which it acquired its reinforcing properties. Because generalized conditioned reinforcers acquired their value through pairing with a variety of other reinforcers, the organism need not be deprived of any specific reinforcer. But it's likely the organism would be deprived of at least some relevant type of reinforcer. For that reason, generalized conditioned reinforcers will be effective most of the time.

In a token economy, a resident would not normally have just consumed all her potential backup reinforcers during the previous day or even the previous week. So, in that sense, she would have been deprived of at least some backup reinforcers. For example, even if they had just gone for a walk, she probably hadn't just talked to the chaplain, or just seen the movie of the week, or just had access to a valuable grooming accessory. Therefore, generalized conditioned reinforcers, such as tokens, are useful in some behavioral interventions. Here's why: Probably at least one of the backup reinforcers the tokens can be exchanged for will be reinforcing for the person at any point in time (i.e., less of a problem of "satiation" than if we're only using one reinforcer, such as Cheetos).

Definition: PROCEDURE

Token economy

- A system of generalized conditioned reinforcers
- in which the organism that receives those generalized reinforcers can save them and
- exchange them for a variety of backup reinforcers later.

Incidentally, some token economies may have deadlines. For example, if you don't redeem your coupon before the end of the year, it won't be valid. Also, notice that this definition somewhat stretches the meaning of "token." *Tokens* normally imply a distinct set of items you can hold in your hand: subway tokens, casino tokens, poker chips, money. We think that's too restricting; it would rule out too many token economies where the "tokens" are marks on a sheet of paper rather than a set of distinct objects the participants can handle.

The Ayllon and Azrin study gives us some insight even into our own economic system. In their study, tokens functioned like money functions for you and me. Tokens are generalized conditioned reinforcers, and so is money. Both tokens and money have acquired their reinforcing value through either direct pairing or verbal pairing with other reinforcers.

But the main practical purpose of Ted and Nate's experiment was to show how a small staff could administer a token economy for 44 psychiatric residents, 24 hours a day, 7 days a

* Ted and Nate also took advantage of the residents' verbal skills in another crucial way. As you will see in the final chapters of this book, the behavioral contingencies are actually indirect-acting, rule-governed analogs to reinforcement, rather than direct-acting reinforcement contingencies. The staff told the residents what the contingencies were; in other words, the staff gave the residents rules describing those contingencies (e.g., *If you make your bed, you will get some tokens*). It was the statement of the rules describing the contingencies rather than the contingencies themselves that controlled the residents' behavior, at least initially. This is especially true to the extent that the staff gave the residents the tokens at the end of each day rather than immediately. But don't worry too much about this now, as we'll get into rule-governed behavior in more detail starting with Chapter 22.

** The BACB task B-8 says, "Define and provide examples of unconditioned, conditioned, and generalized reinforcers and punishers." But after thinking about it, I don't believe there are generalized negative reinforcers. If you can come up with any examples, you get five cool points.

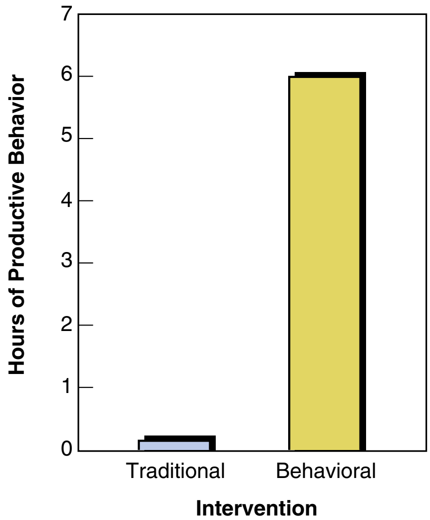


Figure 12.2 Using a Token Economy to Increase Average Daily Productive Behavior per Resident on a Psychiatric Ward

week. (The staff consisted of a behavior analyst, a nurse, and five attendants—by the way, this is the typical staff–resident ratio.) Such a token economy allows us to work with a large number of residents at a single time. These procedures also have been valuable in applications at other institutions, and they have brought hope to normally hopeless situations.

Oh, yes, we got so excited describing the procedure that we almost forgot about the results. Success city: The frequency of various appropriate behaviors went way up. Each of the participating residents worked productively for the 6 hours available each day (Figure 12.2).

We should mention that you don't get great results like this by accident, especially when you're breaking new ground like Ted and Nate were; they spent a year and a half doing preliminary research before starting this experiment. Nothing that good comes easily, at least not in science.

QUESTIONS

1. *Generalized conditioned reinforcer*—define it and give an example.
2. *Token economy*—define it.
3. Describe research on a token economy in a psychiatric hospital:
   a. Who were the participants?
   b. What were some responses?
   c. What were some backup reinforcers?
   d. How did the behavior analysts establish the tokens as generalized conditioned reinforcers?
   e. What were some results?

Concept
Behavioral School Psychology

THE TOKEN ECONOMY AND REMEDIAL EDUCATION

Dr. Montrose Wolf and his colleagues at the University of Kansas headed a project to help financially disadvantaged children hurdle the barriers to a sound education. They helped 16 fifth- and sixth-grade students, who were all at least 2 years below their grade level on a reading achievement test. The children were from a low-income neighborhood in Kansas City. Most were from families of more than five children. The families got public assistance, and often no father was present. The parent or parents voluntarily enrolled the children in Mont's remedial class.[4]

Mont and his colleagues set up the classroom in the basement of a church. During the school year, the students attended the special classroom each weekday after school and on Saturday mornings for 2 1/2 years. During summer, they attended school every morning, except Sunday.

They used a token economy, but they used checkmarks as the generalized conditioned reinforcers, as their form of tokens. The teacher placed checkmarks in the students' folders after they had finished an assignment correctly. When the children first joined the program, the teacher gave them this generalized conditioned reinforcer after the satisfactory completion of each problem. As the students achieved a higher frequency of work and a more accurate output, the work needed to obtain the generalized conditioned reinforcers gradually increased in amount and difficulty. Sometimes students negotiated with the teacher the number of checkmarks a particular amount of work would earn.

The students could exchange these generalized conditioned reinforcers for various backup reinforcers. These included things like fun weekly field trips, daily snacks, items from the school store, and even money and shopping trips.

The children earned these tokens for three general types of activities:

- completed work from the regular classroom
- completed homework assignments and remedial work in the remedial classroom

- good 6-week report card grades (an *A* paid off maximally and an *F* paid nothing at all)

The teachers also used other reinforcer-based procedures with the students. Productive students were given more responsibilities, such as helping to instruct their classmates or to grade their assignments. Perfect attendance was rewarded with substantial bonuses on a monthly basis. If a student's grade average improved over a period of 6 weeks, that student got a party. The teachers also made some classes more fun by having game days involving quiz bowls or Jeopardy-like games. And if a student got an *A* on a test from a regular class, it counted toward a weekly contest where he or she could win candy bars for the group.

In addition, the behavior analysts used a few punishment contingencies to decrease inappropriate behavior:

- An alarm clock rang at three random times during each 2 1/2-hour session. Students got a negative mark after their names on the blackboard if they were out of their seats when the alarm rang.
- They also got negative marks for any other disruptive behavior, such as hitting another student.
- Also, the teachers in the public school classrooms could give points and remove store privileges from students who attended their classes. They did this by sending reports to the remedial classroom teacher.*

At the end of the day, the student with the fewest negative marks earned a large number of extra positive checkmarks in his or her folder. To put it another way, the other students lost the opportunity to earn those extra reinforcers. That wasn't all: Any student who got more than four negative marks lost a privilege, such as the use of the store at the end of the day.** The behavior analysts also used reinforcers to encourage the parents to support the academic behavior of their children. Wolf and his crew included in the store items of interest to the students' families. The students could purchase those items with the checkmarks they had earned for good work.

The program also involved the use of generalized conditioned reinforcers for the instructors. So, in that way, Mont Wolf and his colleagues also supported effective instruction. They gave a bonus of 10 dollars to the assistant instructors whenever a student brought in a 6-week report card with a grade average higher than that of the previous 6 weeks.

This is a great arrangement, probably something only a person skilled in the use of generalized conditioned reinforcers could dream up. But was it effective? Yes. Students often asked to continue their academic work after the remedial session. Also, the students attended about 85% of the remedial classes, though the program regularly met on Saturdays and most holidays. (The students voted to work on school holidays. However, the instructors drew the line at working on Thanksgiving and Christmas day.)

The students worked hard, but did they learn? Yes, the results were impressive. During each of the preceding 2 years, the students had advanced 0.6 grade levels per calendar year on a scholastic aptitude test (SAT). During the year of the token economy, the typical gain was 1.5 grade levels per calendar year on the SAT. A similar group of students (the control group) who had not been in the generalized conditioned reinforcer program showed a gain of only 0.8 grade levels per calendar year in that same period of time. During that year, the report card grade average improved from a *D* to a *C*, while the comparison group showed practically no improvement.*** (See Figure 12.3.)

Was it cost-effective? Was it worth it? Each student earned \$250 during the school year—a small amount of generalized conditioned reinforcers for the large reinforcer going to the society that makes valuable citizens out of people who might otherwise be lost.

* Probably, the teachers in the public school classrooms would tell the students immediately after the relevant response that they were going to give or remove points, though the actual giving or removing would be done much later by the remedial classroom teacher. And probably a teacher's immediate statement would be a conditioned reinforcer or a conditioned punisher, depending on whether it involved the promise of giving or removing the points. But the delay between giving and removing and the actual giving and removing is undoubtedly too great for the statements to have acquired their reinforcing and aversive values through the simple pairing procedure defined earlier in this chapter. Instead, those values must have been acquired through some sort of verbal, rule-governed analog to a pairing procedure, a pairing procedure that would not work with animals and nonverbal human beings.

** Again, the extra reinforcing and aversive properties these contingencies added to the positive and negative marks must also have been the result of some sort of complex, verbal, rule-governed analog to a pairing procedure.

*** Of the 16 students, unfortunately, one of the older sixth graders dropped out during the spring term. She married and dropped out of school. So these results don't apply to her.

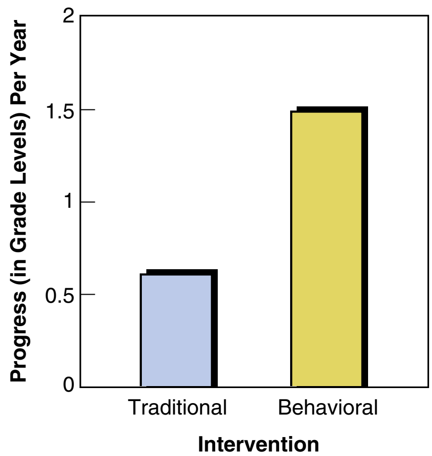


Figure 12.3 Tokens Improve Remedial Education

QUESTION

1. Describe the use of generalized conditioned reinforcers to help remedial grade-school students:

a. What were the generalized conditioned reinforcers?
b. What were some backup reinforcers?
c. What were some different reinforcement procedures used?
d. What was a punishment contingency?
e. How did the behavior analysts encourage social reinforcement in the classroom?
f. How did they encourage the parent's support of the student's academic performance?
g. What were the academic results?

The Morality of Remedial Education

In recent years, our society has shown much concern for the financially disadvantaged. In earlier times, society thought that impoverished people deserved their poverty. Those who were poor were poor by choice. They lacked the moral fiber, the get-up-and-go of the successful. They were lazy and shiftless, deserving nothing better than their lowly status. It was never clear what caused the faulty makeup of the poor. Was it a result of an unfortunate heredity or an impoverished environment? In either case, the rich thought the poor deserved every misfortune that befell them. The successful had no reason to pity the less fortunate. Many years ago, people held similar attitudes about men and women in insane asylums. The notion was that people have behavioral flaws, and they should suffer for them.

Today, most of us strive for a more rational, humanitarian attitude. Now most enlightened people believe we should make every effort to help others overcome the limitations of impoverished backgrounds. We should not judge a society by how it treats its successful, strong, powerful members; instead, we should judge a society by how it treats its weak and defenseless members. And many contemporary societies now treat their weak and defenseless well—better than at any time in history.

Many societies have invested much time, money, and human resources to help the less fortunate. Unfortunately, without an appropriate understanding of the laws of behavior, the benefits may not be great. Because of the large contribution behavior analysis is making in helping the less fortunate, we feel good to be part of the behavioral movement. We feel especially proud to be behaviorists when we read about the work of Mont Wolf and his colleagues. They creatively used generalized conditioned reinforcers to help a group of financially disadvantaged students, and that impresses us.

QUESTION

1. What's the humanitarian attitude about how we should judge a society?

Concept

CONDITIONED PUNISHERS

One-year-old Rod sat stirring his applesauce with his baby spoon, making a general mess of things. This irritated Sid. "No, don't do that! No, I said." Whack! A mild, little smack on Rod's hand.

Pairing With Punishers

No! → smack

no *No!* → no smack

Dawn looked at Sid, wishing he were a little gentler with their baby. On his part, Rod sat there whimpering. But a little later, he started making a mess with his applesauce again. Dawn was quick to intervene before Sid had a chance. All she said was "No." Rod kept messing. "No" again, but this time she immediately took his applesauce and spoon away from him.

Pairing With Loss of Reinforcers

No! →	lose applesauce
no *No!* →	have applesauce

In this way, *no* was reliably paired with punishers (like the slap) and with the loss of reinforcers (like the loss of the applesauce). This also was a value-altering procedure that caused *no* to become a conditioned aversive stimulus.

Definition: CONCEPT

Conditioned punisher

- A stimulus that is a punisher
- because it has been paired with another punisher.

Remember the value-altering principle? *The pairing procedure converts a neutral stimulus into a conditioned reinforcer or conditioned punisher*. Earlier we saw how the value-altering principle describes the creation of conditioned reinforcers. Now Rod's story shows how the value-altering principle describes the creation of conditioned punishers. The pairing of *no* with various punishers and losses of reinforcers is how *no* becomes such a powerful conditioned punisher. But how do we know *no* was aversive for Rod? Because it punished the behavior that preceded it. Of course the combination of *no*'s, slaps, and losses of the applesauce soon formed an effective punishment contingency that suppressed Rod's messing. But eventually all it took was a few *no*'s contingent on some undesirable behavior and that undesirable behavior would stop. That's fairly good proof that *no* had become a conditioned punisher. For example, every time Rod started picking at a scab on his knee, Dawn said, "No."

Before	Behavior	After
Rod hears no aversive *no.*	Rod picks at his scab.	Rod hears an aversive *no.*

And all it took was a few contingent *no*'s from Dawn for his picking to be sufficiently punished that Rod stopped doing it, and his scrape was allowed to heal.

For most of us, the word *no* has been paired with a variety of aversive stimuli and the loss of a variety of different reinforcers. So, for example, even though we might not be deprived of applesauce, *no* is still aversive. So, just as we have generalized conditioned reinforcers, we also have generalized conditioned punishers. And they probably play a very important role in our lives, though I know of no research done on this topic. (Generalized conditioned punisher refers to a conditioned punisher that is a punisher because it was paired with a variety of other punishers or conditions and/or the loss of a variety of other reinforcers.)

In summary, a neutral stimulus (event, activity, or condition) becomes a conditioned punisher when it has been paired with an original punisher. And this original punisher could be either an unconditioned or a conditioned punisher.

QUESTIONS

1. *Conditioned punisher*—define it and diagram an example of creating a conditioned punisher by
   a. pairing with a punisher
   b. pairing with the loss of a reinforcer
2. Show how we could know that *no* is a conditioned punisher.

Concept

HOW DO CONDITIONED REINFORCERS AND PUNISHERS LOSE THEIR REINFORCING AND PUNISHING VALUE?

What happens if we stop pairing the conditioned reinforcer with some other reinforcer? What happens if we stop pairing *Good!* with food?

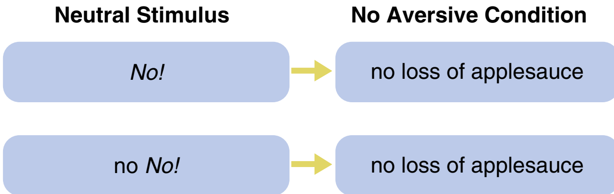
Unpairing With Positive Reinforcers

Neutral Stimulus	No Reinforcer
Good →	***no*** food
no *Good* →	no food

Then *Good!* will lose its reinforcing value for Jimmy.

And what happens if we stop pairing the conditioned aversive stimulus or condition with some other aversive stimulus or condition? What happens if we stop pairing *No!* with the loss of reinforcers?

Unpairing With Negative Punishers



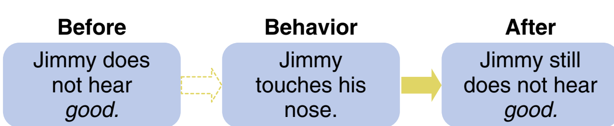
You guessed it; *No!* will lose its aversive value.

Unpairing happens most often as a result of failing to immediately present the original reinforcer (or original aversive stimulus) after the conditioned reinforcer or aversive stimulus, but there's another way we can do the unpairing. We could have food continuously available. Then the food would be no more paired with "Good boy!" than with anything else.

EXTINCTION VS. THE UNPAIRING OF CONDITIONED REINFORCERS AND CONDITIONED AVERSIVE STIMULI

Conditioned reinforcers lose their reinforcing value because they are no longer paired with the original reinforcer. This is not extinction. Extinction consists of no longer making a reinforcer *contingent* on a response. You just saw a diagram of the unpairing procedure. Here's a diagram of the extinction procedure.

Extinction Procedure



The *results* of unpairing differ from the results of extinction as well. As a result of unpairing, a conditioned reinforcer loses its reinforcing value; and that conditioned reinforcer will no longer reinforce any response. But as a result of extinction, response frequency of a previously reinforced response also decreases; however, that conditioned reinforcer may still be reinforcing other responses on which it is contingent.

Similarly, the *results* of unpairing differ from the results of stopping the punishment contingency. As a result of unpairing, a conditioned aversive stimulus loses its aversive value; and that conditioned aversive stimulus will no longer punish any response. But as a result of stopping the punishment contingency, the frequency of a previously punished response also increases; however, that conditioned aversive stimulus may still be punishing other responses on which it is contingent.

Unpairing vs. Extinction

	Unpairing	Extinction
Process	Present conditioned reinforcer without presenting the unconditioned reinforcer	No longer present the reinforcer contingent on the response
Results	Conditioned reinforcer loses its reinforcing value	Response frequency decreases (but the reinforcer has not lost its value)

QUESTIONS

1. Give an example of how conditioned reinforcers and conditioned aversive stimuli lose their value.
2. Show how this differs from extinction and stopping the punishment contingency.

Concept

CONDITIONAL STIMULUS

You've got a quiz over this book, and you haven't opened it since the last quiz. No big deal. But as you get closer and closer to quiz time with your book still collecting dust, the deal gets bigger and bigger. You start getting more and more anxious. The situation is getting more and more aversive. You're not quite breaking out into a cold sweat, but almost. Finally, it's so aversive that you make the escape response, you pick up your book and start studying. And immediately the aversiveness starts to decrease. After you've read, underlined, reread, reviewed the section questions, and memorized the definitions, you're ready to ace the quiz. You're confident. The situation has lost most of its aversiveness, even though it's almost time for the quiz.

So what was the aversive situation? Not having studied the book? No, you've spent most of your life without studying this book, and though you may have been ignorant of behavior analysis, that was not necessarily an aversive condition. And as we just saw, being close to quiz time was not, in itself, aversive. It's a ***combination*** of being close to quiz time without having studied, without being prepared; that's what's aversive. We call such combination situations **conditional stimuli**. Here, *conditional* means *dependent*. Not having studied isn't aversive (at least for most of us). And being close to quiz time isn't too aversive (at least for most of us). But not having studied *and* being close to quiz time is aversive (at least for most of us). We say the aversiveness of either element being aversive is *conditional* on (i.e., dependent on) the other element also being present; it's the combination of the two that's aversive. The aversiveness of not having studied is *conditional* on being near quiz time. Or, to put it the other way, being near quiz time is aversive, *conditional* on not having studied.

Here's another one: As you are about to leave for a Saturday-night party, Mom says, "You look very sharp, dear." You immediately check yourself out in the mirror to see what's wrong, because you know if Mother likes it, you certainly won't. Her intended compliment functioned as an insult, not a reinforcer but a punisher. On the other hand, when your date says, "Hey, like, you look cool," the compliment is a compliment, a powerhouse reinforcer. "You look nice" is a reinforcer conditional on your date saying it and an aversive conditional on Mom saying it. Whether the intended compliment is a reinforcer or an aversive condition is conditional on (dependent on) its source.

Some stimuli may be conditioned reinforcers or aversive stimuli *only* when they occur in the presence of some other stimulus, only *conditional* on the presence of some other stimulus. We call them **conditional stimuli**.

Definition: CONCEPT

Conditional stimulus

- Elements of a stimulus
- have their value or function
- only when they are combined;
- otherwise, the individual elements may be neutral.

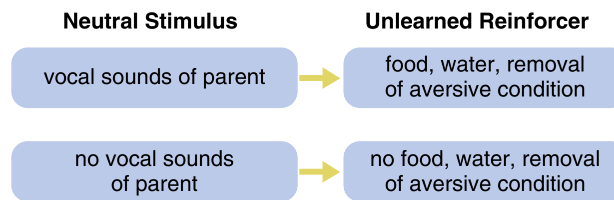
QUESTIONS

1. Define *conditional stimulus*.
2. Give an example of a conditional punisher and explain the details.

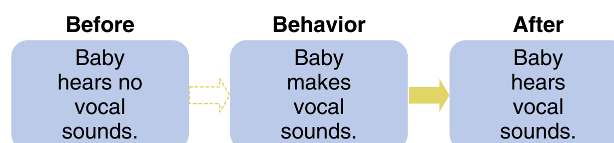
CONDITIONED REINFORCERS AND LEARNING LANGUAGE

Babies begin to babble long before they begin to talk. Ever noticed that babies tend to "babble" in their own language? Listen to a Japanese baby babble, and it will sound like Japanese. Why?

We've seen how neutral stimuli paired with unconditioned reinforcers become conditioned reinforcers. When these pairings first take place for an infant, many neutral stimuli can acquire reinforcing properties. The parents talk when feeding, diapering, and taking care of their baby. And the sounds of the parent's talking are paired with those reinforcers (food, comfort, etc.), so the parents' vocal sounds become conditioned reinforcers.

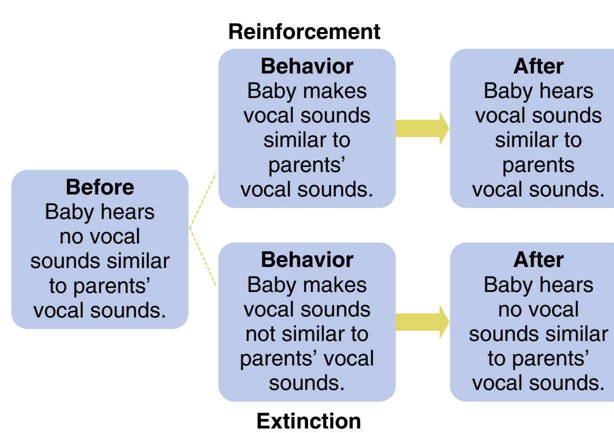


When the baby begins to produce vocal sounds, those sounds are conditioned reinforcers that automatically reinforce the behavior of emitting them.



But it doesn't stop there. Sounds that are more like the parent's speech are more reinforcing than sounds that aren't. Therefore, these sounds are differentially reinforced and we get variable-outcome shaping. As the baby gets better and better at approximating Mom and Dad's vocal sounds, the reinforcers produced will be better and better and keep shaping the behavior into speech sounds.

Differential Reinforcement



Gradually, the nonverbal vocal sounds that the baby makes will begin to sound more and more like language in general and the parents' language in particular, even though the baby's babbles don't yet have any verbal function.

QUESTION

1. Why do Japanese babies babble in Japanese and American babies babble in English?

CONTROL OVER YOUR ENVIRONMENT AS A CONDITIONED REINFORCER

Now our kids with autism can get hooked on conditioned reinforcers, just like you and I do. For example, many of the kids do not have what we'd consider good play skills, so one of the first things we often do is teach them how to play with puzzles. We start with a very simple, three-dimensional, five-piece puzzle, and gradually increase their puzzle skills until they can skillfully put together 15- or 20-piece, two-dimensional puzzles, teaching them the puzzle skills with bags of M&Ms, Cheetos, and high fives, first, with a Cheeto following each correctly placed piece, until eventually with a Cheeto following the completion of the whole puzzle, and then eventually after that with no Cheetos, not even a high five. And when free to select, the kids often pull out a puzzle and use their precious play time to assemble the picture. It's fun! What's fun, looking at the picture? Not so much; after they assemble the picture they often tear it apart again, sometimes just to reassemble it. Building the picture is fun—that's the reinforcer! Having control over your environment! Being skillful! A powerful conditioned reinforcer. Why? Perhaps because all of us, including the kids, get more reinforcers (and get them more quickly) the more skillful we are at controlling our environment, putting Cheetos in our mouth, not our ear, turning on the TV, and stealing Mama's iPad. Well, for the kids maybe, but not for you and me! Right, but one time I did spend 8 straight hours playing Tetris, when it first hit the United States. And what's the largest number of consecutive hours you've spent playing some silly video game? And why? Having control over your environment! Being skillful! That's a powerful conditioned reinforcer.

QUESTION

1. Give a couple examples of control over the environment as a powerful conditioned reinforcer.

THE COMPLEXITIES OF CREATING CONDITIONED REINFORCERS

Creating a Conditioned Reinforcer

Earlier, we talked about helping Jimmy get turned on to social reinforcers. Now let's dig a little deeper into that process, because motivation is a big problem when trying to help kids with autism. In other words, it's often hard to find reinforcers for them, and it's especially hard when we want to get away from M&Ms and Cheetos. And it's even harder when we want to use conditioned reinforcers, like praise. A common error is to use verbal praise with nonverbal kids—kids who don't talk and who don't understand language. "Good job!" "Wonderful." "I'm so proud of you." It's just noise to the kids—meaningless, and not reinforcing. If you must use verbal praise, keep it simple and always the same thing, said the same way. "Good!" "Good!" "Good!" And then follow it *immediately* with an M&M or a Cheeto. Don't dig around in the M&M bag, find the one that's the right color, pull it out, split it in half, and then give the half to the kid. By this time, he's on the floor, wiggling around, so now you're reinforcing wiggling on the floor. But more to the point of this chapter, you want to pair the M&M immediately with the "Good!" so that with enough pairings, "Good!" will have a fighting chance of becoming a powerful, conditioned reinforcer. Have that 1/2 M&M waiting in the palm of your hand, and hope it doesn't melt before he makes the correct response; then you say, "Good!" and give it to him. And don't you dare eat it yourself, even if it is almost lunchtime. (Are M&Ms guaranteed not to melt in your hand just to protect behavior techs who aren't on top of their game?)

(By the way, don't rationalize giving the kid a wide variety of different forms of praise by saying you're teaching him language. If he could learn language that way, he'd have done so long ago.)

Eventually you'll want a variety of different words said by a variety of different voices to become conditioned reinforcers, not just your "Good!" But because we have so much trouble establishing a strong conditioned reinforcer with these kids, and having a strong conditioned reinforcer is so important, I'd make sure I had one really strong one, before going for a wide variety.

(I use M&M and Cheetos in our examples because that's what people use, and because I'm making fun of our using them, and because I think Cheetos sounds cute. But of course these are unhealthy crap foods. If you can get away with using bits of grapes and unprocessed fruit, you'll get all sorts of cool points and maybe extend your kid's life a few months or years.)

No Descriptive Praise

The kid can't talk. He doesn't understand language. And your presumed reinforcers are descriptive praise. "Good job washing your hands!" "Good job matching same with same!" "Good job hanging up your coat!" He doesn't understand! Stop it! Just, "Good!"

(Only after the kid has acquired pretty good language skills do you want to use descriptive praise, where it will function more as feedback for what he should do the next time than as a reinforcer for the particular behavior described.)

How to Make Speech Sounds Conditioned Reinforcers[5] *(G-11)*

Earlier we said that not only do babies babble, but they even babble in the speech sounds of their parents. Why? Because those speech sounds have become conditioned reinforcers. But many kids with autism never babbled. Why not? Probably because the speech sounds never became conditioned reinforcers. Many are completely silent. Some may squeal a bit. Others may occasionally make a syllable sound. But many never learn to talk.

However, behavior analysts are beginning to correct this. Brighid Fronapfel-Sonderegger paired speech sounds with reinforcers. For example, she'd say "mmm" three times, give the child the M&M, and say "mmm" two more times while the child was eating it, first preceding and then directly pairing "mmm" with the delicious taste. And if the child would say "mmm" before Brighid's third "mmm," she'd get that M&M immediately.

Brighid would start with a single syllable and eventually shape a word, for example, "e," "ese," and "cheese." They also got to "Goldfish" in three easy, shaping steps. And so on. Furthermore, throughout the day the children's behavior techs would deliver the named reinforcer every time one of the children would say one of the magic words. As a result of all this, the children were learning to use words to request their reinforcers, rather than pointing or dragging someone to the out-of-reach Cheetos or throwing a tantrum. Very cool—very important, for the child, for the family, for the world.

Social Reinforcers

But behavior analysis and the kids with autism aren't out of the woods yet. By and large, we and the kids still have a long way to go. We're getting pretty good at teaching the kids to request their reinforcers. (Technically, we call these requests **mands**.) "What do you want to work for, Jimmy?" "Cheeto, please." Like you're surprised?

And we can even teach them to name or label all sorts of things. "Cow." "Truck." "Dora." "Mommy." (Not necessarily in that order.) But they must get a Cheeto after each one, more or less. And we have a hell of a time getting the kids to talk to us, just for the sake of talking to us, just because they enjoy talking to us about this and that, just because we show an interest in what they have to say. Often they could care less about us, about our showing an interest in them, about our approval, about whether we even exist—ah, unless we have a game-loaded iPhone in our pocket or a bag of Cheetos in our hand.

In other words, our next big challenge is to establish other people as conditioned reinforcers for the kids and not just instrumental reinforcers, not just instruments for getting a few more Cheetos. If we ever get to the point where the kids are spending half as much time as you are picking up puny, little social reinforcers on Facebook, we'll have won most of the battle. Ah, how many "likes," how many invites, how many friend requests did you get today? (Of course, conditioned social reinforcers aren't the whole story, but they're a big part of it. And of course, many kids with autism are just as much into social approval as you and I are, but way too many are absolutely not; they don't even notice if you're in the room. And this is one of the areas where much big-time research is needed.) (P.S. **Tacting** is our technical term for this labeling or naming of cows, trucks, Doras, and mommies.) (P.S. 2. Of course, as one of my Facebook buds pointed out, you need to use a variety of reinforcers for tacting "cow" and not just Cheetos; otherwise, "cow" will come to function as a specific request [mand] for a Cheeto. That's right you have to be on your toes when you're working with these kids, or you'll screw it up.)

QUESTIONS

1. When creating praise as a conditioned reinforcer for a child with autism:

   a. How soon should the backup reinforcer follow the praise?
   b. When should you introduce a variety of praises?
   c. When should you introduce descriptive praise?

2. For many children with autism, it's much easier to teach them to tact (label) objects than it to get them to value your attention.

   a. true
   b. false

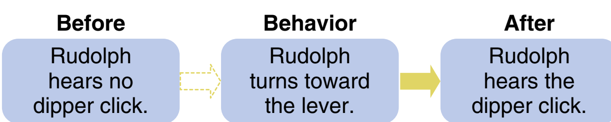
In the Skinner Box
Experimental Analysis

CONDITIONED REINFORCERS

How do you establish a conditioned reinforcer for Rudolph? By pairing water with the click of the brass water dipper as it comes up from the water reservoir and strikes the aluminum floor through which it protrudes.

Now according to our value-altering principle, the dipper click should become a conditioned reinforcer, at least after it's been paired often enough with the water.

This is part of what we call *dipper training*. And it's critical that the dipper click becomes a powerful conditioned reinforcer if you're going to succeed in shaping Rudolph's lever pressing. Here's how it works: Rudolph is in the other side of the cage. He turns slightly toward the lever, and you click the dipper. Because the click of the dipper has become a conditioned reinforcer, that sound reinforced Rudolph's turning toward the lever. Next, you require Rudolph to turn more directly toward the lever before you present the magic dipper click.*



Of course *you* would make sure the time between the click and the water is very brief. So now you've got Rudolph gingerly touching the lever. You've clearly trained a response—touching the lever.

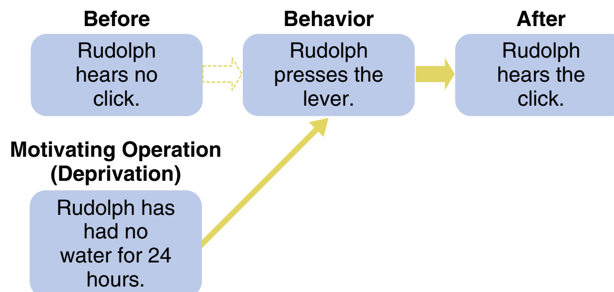
Conditioned Reinforcers and Deprivation

So pairing the dipper click with the water will make it a conditioned reinforcer, but not unless Rudolph has been deprived of water. If Rudolph has just drunk his fill of water, pairing the click with more water probably won't do the trick. And the same thing holds for creating generalized conditioned reinforcers. We might do this by pairing the click with water sometimes and with food other times. But when we do, we'd better make sure that he's been deprived of water when we pair the click with water and deprived of food when we pair it with food. Then, in the future, whether he's deprived of water, food, or both, the click should be an effective conditioned reinforcer.

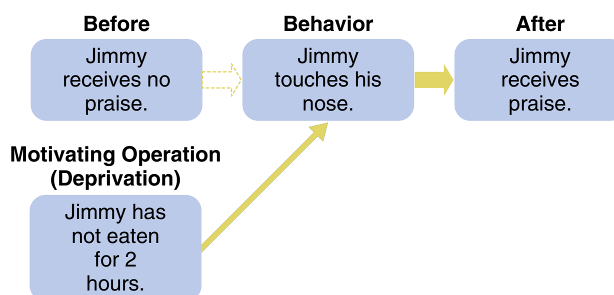
Some Confusions

Danger: Here are some issues that often confuse students:

First, Rudolph needn't make the response that produces the click in order for the click to become a conditioned reinforcer. We could completely remove the lever from the Skinner box during the pairing procedure that causes the click to become a conditioned reinforcer. All we need is the pairing. But, he must make the response that produces the click in order to demonstrate that the click has become a conditioned reinforcer.



And the same thing applies to Jimmy: We needn't deprive Jimmy of praise for praise to be an effective reinforcer. Instead, we must deprive him of at least one of the unconditioned backup reinforcers that have been paired with praise, if praise is to be an effective reinforcer.



Although not all behavior analysts seem to agree, I think it's crucial that we deprive Rudolph and Jimmy of the unconditioned backup reinforcer, not that we deprive them of the conditioned reinforcer, if that conditioned reinforcer is to be effective. Furthermore, I think more behavior analysts would agree if they would carefully take the analysis from applied human research back to the Skinner box, where life is a little simpler and much clearer.**

And finally, as long as the conditioned reinforcer is occasionally paired with the unconditioned reinforcer, it will continue to reinforce a response, even though that response never produces the unconditioned reinforcer. However, as we mentioned earlier, stopping the pairing procedure will cause the conditioned

* But suppose you often clicked the dipper while Rudolph was in the other side of the cage scratching himself. And 5 minutes later he moseyed over to the dipper and got the water. Now that's not exactly what we'd call pairing the click and the water; the delay's way too great. So, if you squandered most of your water reinforcers that way, you'd get what you deserved—a rough time training Rudolph's lever pressing.

** Though I'm skeptical that deprivation of conditioned reinforcers is needed for them to be effective reinforcers, the term for this deprivation procedure is called the ***conditioned motivating operation*** or the ***surrogate motivating operation***.

reinforcer to lose its reinforcing value (this is not to be confused with operant extinction where the reinforcer is no longer contingent on the response). So the contingent sound of the click would reinforce an arbitrary response such as Rudolph's pulling a chain that dangled from the ceiling of the Skinner box. And the click would maintain the chain pull indefinitely as long as the click was sometimes paired with water, though that pairing need not follow the chain pulls.

QUESTIONS

1. Diagram the creation of a conditioned reinforcer in the Skinner box.
2. Must Rudolph make the response that produces the click, in order for the click to become a conditioned reinforcer?
   a. yes
   b. no
3. What is the crucial deprivation for a conditioned reinforcer to be effective?
   a. deprivation of the conditioned reinforcer
   b. deprivation of the backup reinforcer (e.g., food that had been paired with praise)
4. Can you condition Rudolph's response with a click (conditioned reinforcer), even though that response has never produced the click/backup reinforcer combination?
   a. yes
   b. no

PSYCHOTIC TALK—THE SEEDS OF THE BEHAVIORAL REVOLUTION

In 1959, Ted Ayllon and Jack Michael published the first research showing a behavioral approach to what people call *mental illness* or *psychiatric disorders*. Their research included Helen's case and the case of Lucille, the restless resident discussed in Chapter 2. Their article was based on Ted's doctoral dissertation. Few dissertations have had such an impact on our field.

At that time, I was a doctoral student doing Skinner box research in the experimental analysis of behavior at Columbia University. The article excited us grad students. We saw it as the forerunner of the application of scientifically established principles to helping psychiatric clients.

Scientists had developed these principles in the laboratory doing experiments with animals. We ourselves were doing this type of basic research, and we loved seeing the results applied to important human problems. At last, we might be able to convince our critics who couldn't see how our research was relevant to human affairs. Ted and Jack showed the relevance. But we thought the article had even greater importance than just convincing the skeptics that we weren't frivolously wasting time and money on impractical intellectual games.

The article also showed that it is possible to develop strong ties between the experimental analysis of behavior and applied behavior analysis. The sciences of biology and chemistry support the practice of clinical medicine, and the sciences of physics and chemistry support the practice of engineering. But, unfortunately, the science of experimental psychology did not support the practice of traditional clinical psychology—and, to a large part, it still doesn't. Much, and perhaps most, of clinical psychology is without scientifically proven practices. Unfortunately, there is little scientific evidence to support traditional clinical psychology. And without that scientific backbone, clinical psychology will never achieve the helpfulness and respect of clinical medicine.

Then, along came Ayllon and Michael. They didn't try to salvage traditional clinical psychology. Instead, their experiment created a whole new field—applied behavior analysis. At last, we had an applied field (applied behavior analysis) with a solid scientific backbone (the experimental analysis of behavior); and, ever since 1959, applied behavior analysis has been moving up the steep hill toward achieving the same level of helpfulness and respect that clinical medicine has earned. In the meantime, traditional clinical psychology has made little progress in that direction.

Behavior analysis has revolutionized the approach to solving human problems, whether those problems are in the traditional areas of clinical psychology, educational and school psychology, special education, social work, or industrial and organizational psychology. We now have a scientifically proven base and practices to help us improve the well-being of humanity. We no longer need to rely only on intuition, tradition, and superstition. We have much yet to learn, but now that our science and practice are one, we are systematically understanding more and more of how the human world works and how to help it work better. By whatever name, the experimental analysis of behavior and applied behavior analysis have proven an unbeatable combination.

QUESTION

1. Why was the Ayllon–Michael research so important?

Research Methods

PROOF OF A CONDITIONED REINFORCER IN THE SKINNER BOX

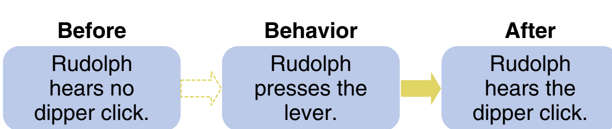
Here's the big question:

> Is Rudolph's reliable lever touching good evidence that the dipper click is a conditioned reinforcer?
>
> a. yes
> b. no

Not bad evidence, but not the best evidence either. His reliable touching isn't bad evidence because it would be so hard to shape successive approximations to the lever touching without the dipper click as a conditioned reinforcer, especially if you had a fairly large Skinner box. A large box would allow Rudolph to stray far away from the lever and make it real hard to get him moving toward it without the dipper click as a conditioned reinforcer.

Why isn't reliable touching the best evidence? Because it's always possible, though not probable, that Rudolph could have learned lever touching without the click, just the water. Maybe you'd have just as good results if Rudolph were deaf and couldn't even hear that click. Not likely, but maybe.

Then what would be better evidence? Empty the water out of the water reservoir and train a new response with just the click, like maybe pushing the lever all the way down. Suppose you managed to move Rudolph from just touching the lever to actually pressing it all the way down, and all you used was the response-contingent dipper click. Then even skeptics would believe you've got a conditioned reinforcer in that click.



But if you really wanted to impress us, you might use only the dipper click to train a brand-new response, like pulling that chain—the one dangling from the Skinner box ceiling.

> Suppose Rudolph were deaf and he still learned to press the lever. Does that mean the water was a conditioned reinforcer?
>
> a. yes
> b. no

Remember that conditioned reinforcers were originally neutral stimuli that became reinforcers because they had been paired with other reinforcers. Water was a reinforcer, even without such pairing. Just because the water reinforcer helped Rudolph learn, lever pressing doesn't make it a conditioned reinforcer.

QUESTION

1. How would you provide good evidence that the dipper click really was the reinforcer?

Research Methods

DETERMINING THE EFFECTIVENESS OF TOKENS AS REINFORCERS

Ruling Out the Environmental Enrichment View

Recall the token economy Ted Ayllon and Nate Azrin used in the psychiatric institution. They asked whether the tokens were acting effectively as reinforcers. Perhaps the residents found the tasks themselves reinforcing enough. Or the use of the tokens might have been an example of superstitious behavior on the part of Ted and Nate. In trying to determine the effectiveness of the tokens as reinforcers, our first suggestion might be to stop giving the tokens altogether. But we have seen in an earlier chapter that such a procedure is not scientifically sound. Why not? When we know something acts as a reinforcer, we are saying that it will increase the frequency of the response that it immediately follows. Perhaps the psychiatric residents' good performance simply resulted from the mere presence of the tokens and the attention the residents received when they got the tokens. Perhaps the attention and the tokens made the residents so happy that they behaved as desired. In other words, perhaps the tokens didn't have to follow the response; it was only necessary to receive the tokens—sort of an environmental enrichment view.

To rule out the environmental enrichment view, we need to make sure the residents still get the tokens but that the tokens don't immediately follow the responses of interest. So Ayllon and Azrin gave the tokens to the residents at the beginning of each day, whether or not they did any work. In that way, the tokens were present, but they didn't immediately follow the response.

Over a period of 20 days with noncontingent tokens, the group's work output decreased from 44 hours to only 1 hour per day. We may consider this to be a form of extinction: The individual residents got the potential reinforcers before having an opportunity to make any responses, and later responding didn't produce additional reinforcers. The decrease in the behavior is what we would expect of the extinction procedure. These data suggest that during the contingency phase the tokens were acting as effective reinforcers in maintaining the desired behavior.

Summary: Noncontingent Reinforcers as a Control Procedure—Part I

These concepts of research methods are hard to understand; so let's summarize them:

- Simply withholding the potential reinforcer (extinction) is not a good enough control procedure to demonstrate the operation of a reinforcement contingency. Why? Because withholding the potential reinforcer removes two possible causal variables:
    1. the contingency involving the presentation of those potential reinforcers, and
    2. the potential reinforcers themselves.
- But, you can noncontingently present the potential reinforcers. That way you've removed the contingency (one of the two possible causes), but you haven't gotten rid of the reinforcers themselves. That breaks the confounding. If the potential reinforcers no longer maintain performance when presented noncontingently, we can be sure those potential reinforcers are real reinforcers and their contingent presentation was crucial.

Ruling Out Chance

A skeptic might claim that Ayllon and Azrin were just lucky. Perhaps when they stopped the contingent-reinforcer procedure, the temperature just happened to change, or something else accidentally happened that lowered the response frequency. So this decrease in the work of the residents might not have been due to the noncontingent reinforcer procedure but rather to some uncontrolled feature. One way to convince the skeptic would be to stop the extinction procedure and reinstate the reinforcement procedure. In other words, use a *reversal design*. When Ayllon and Azrin did this, the total work of the group immediately rose to the preceding average of 44 hours per day, leaving little doubt that the tokens were effectively reinforcing the work (Figure 12.4).

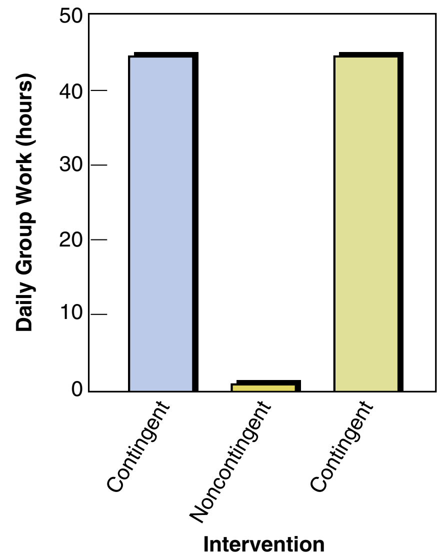


Figure 12.4 Reversal Design Showing the Value of Contingencies

The Flesh Is Willing, But It Needs a Few Reinforcers

Note the relation between what the residents said and what they did. During the first part of the noncontingent-reinforcer phase, several residents continued working for a few days. They said things like this: "I think I'll work even if it is a vacation." "I want to help out here; there aren't enough people to do the work." Yet, eventually, nearly all the residents stopped working. Then the residents said things like this: "I'm not going to do any work if I don't get anything for it." It's probably as true for the rest of us as it is of psychiatric residents: The frequency of our statements about working without reinforcers decreases as the opportunities to do such unreinforced work increase.

Noncontingent Reinforcers as a Control Procedure—Part II

To determine the importance of the contingency, it is better to use noncontingent reinforcers than simply to stop giving the reinforcers (extinction). Why?

To answer this, let's look at another example: The students in my classes work hard and learn a lot. Why? I think it's because I assign a chapter from this book for each class and give them a quiz over that book, and the grade they get on each quiz contributes significantly toward their final course grade. In other words, I think the quiz grade is a conditioned reinforcer. And I think making those quiz grades contingent on their quiz performance is crucial. The contingency does the trick.

But I have colleagues who would argue that the contingency is not important. So I might keep making the assignments and keep giving the quizzes but stop giving any quiz grades. If I did, most of the students would stop studying so hard, would do poorer on the quizzes, and wouldn't learn as much.

I say to my colleagues, "See, the grade contingency was important."

But they just laugh at me and say withholding the quiz grades (extinction) doesn't prove a thing. They say I have to keep giving them the good quiz grades, but I should make them independent of their quiz performance—I should remove the contingency but keep the grades. Giving the free grades would show my students how much I respect them and they would study just as hard, and do just as well on the quizzes, and would learn just as much.

I say, "OK, but now, if my students blow off my quizzes, that proves that it was not just the grades that were crucial; it was crucial that the grades actually be contingent on their quiz performance." If my students do well when the grades are contingent and poorly when they're not contingent, that shows the contingency was crucial, not just the presence of the grades themselves.

Leaving the noncontingent grades, but removing the contingency, is a much better control procedure for demonstrating that it is the contingent grades and not just the grades that are the real cause of the studying and excellent quiz performance.

(By the way, the delivery of the quiz grade follows the studying and taking the quiz by more than 60 seconds, so the quiz-grade contingency is not really a reinforcement contingency. As we shall see in Chapter 25, it's an analog to an avoidance contingency.)

QUESTIONS

1. How can you use noncontingent reinforcers to determine the importance of the contingency?
2. To determine the importance of the contingency, it is better to use noncontingent reinforcers than simply to stop giving the reinforcers (extinction). Why?
3. How can you use a reversal design to determine the importance of the contingency?

Notes

1 Sheffield, F. D., & Roby, T. B. (1950). Reward value of a nonnutritive sweet taste. *Journal of Comparative and Physiological Psychology*, *43*, 471–481.

2 Based on Ayllon, T., & Michael, J. (1959). The psychiatric nurse as a behavioral engineer. *Journal of the Experimental Analysis of Behavior*, *2*, 323–334; Ayllon, T., & Haughton, E. (1964). Modification of symptomatic verbal behavior of mental patients. *Behavior Research and Therapy*, *2*, 87–97. The data in the accompanying figure are based on the first article.

3 Based on Ayllon, T., & Azrin, N. H. (1965). The measurement and reinforcement of behavior of psychotics. *Journal of the Experimental Analysis of Behavior*, *8*, 357–383.

4 Based on Wolf, M., Gives, D. K., & Hall, R V. (1967). *Experiments with token reinforcements in a remedial classroom*. Unpublished manuscript.

5 Fronapfel-Sonderegger, B. (2012). *Teaching language to children with disabilities using combined direct reinforcement and stimulus-stimulus pairing* (Unpublished doctoral dissertation). Western Michigan University, Kalamazoo, MI.

CHAPTER 13

Motivating Operations

Behavior Analyst Certification Board 5th Edition Task List Items

B-12.	Define and provide examples of motivating operations.	Page 263 and throughout
H-5.	Plan for possible unwanted effects when using reinforcement, extinction, and punishment procedures.	Throughout

Concepts
Deprivation and Satiation

JIMMY, THE CHILD WITH AUTISM—PART XI

When Mae and her staff first started working with Jimmy at the Rosa Parks Academy, they needed to use hardcore, unconditioned reinforcers—mainly food. And with food reinforcers, Jimmy worked *and* learned better just before breakfast or lunch, rather than just after. In other words, it helped if Jimmy were a little hungry, rather than a little full. It helped if Jimmy were a little deprived of food, rather than a little satiated. Being a little hungry (a little food **deprived**) helped in two ways, when using food reinforcers:

- Food deprivation made food a more effective reinforcer. In other words, Jimmy would learn more, faster, and with fewer reinforcers if he were a little hungry. (In still other words, food deprivation would improve his ***learning***.)
- And also, Jimmy would work a little harder for those food reinforcers; he'd go through more learning trials in 15 minutes if he were a little hungry; he'd spend less time dawdling. (In other words, food deprivation would increase his tendency to ***perform*** that learned behavior.)

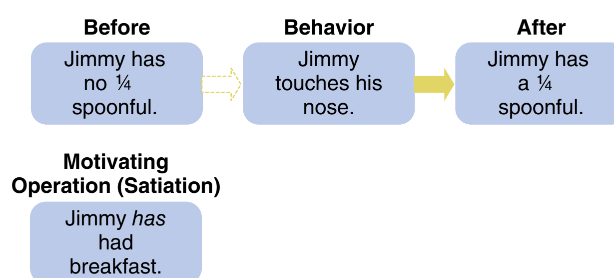
Let's illustrate this with a typical teaching session: Because it was so important to use powerful, unconditioned food reinforcers, many of Jimmy's teaching sessions occurred during extended breakfasts and extended lunch periods.

Eve: Jimmy, touch your nose. (Jimmy had previously mastered touching his nose when his behavior techs asked him to. Jimmy did.)

Eve: GOOD BOY, JIMMY! (And she gave him a quarter spoonful of cereal in skim milk.)

Eve: Jimmy, touch your mouth. (And so on, with more previously mastered skills . . .)

But near the end of breakfast, Jimmy was filling up with cereal and skim milk, becoming a little ***satiated***.*

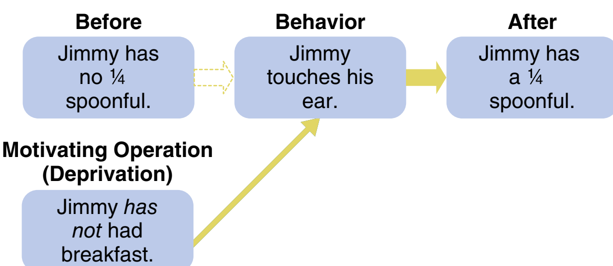


So his latency increased, and he needed more repetitions of the instruction, and even some physical prompts. In other words, **satiation** caused a decrease in Jimmy's tendency to *perform* that response. That is, Jimmy had already learned to touch his nose, when asked to; so we're not talking about learning. It's

* We've removed the arrow connecting the satiation box from the behavior box because we don't want to give the impression that satiation causes the behavior. Really, satiation tends to prevent the behavior. It might be that we'd be better off removing the arrow between the deprivation box and behavior also, but we haven't done that, at least not yet.

just that when he was satiated, he no longer gave a damn about the food; he'd no longer work for it; he'd no longer touch his nose for it. In more other words, satiation was affecting the ***performance*** of his well-learned nose-touching response.

And that's not all. If Eve had started teaching a new response, *touch your ear*, at the end of breakfast, those food reinforcers wouldn't have been very effective—satiation would have taken its toll once again. In other words, the next day, Jimmy would have shown little learning of ear touching; the frequency of that response would have been low. But suppose Eve had taught ear touching early in the meal when Jimmy was clearly food deprived.



Then the next day, he'd probably have responded to most of Eve's requests that he touch his ear, at least if he hadn't had breakfast yet. Satiation while learning would hurt Jimmy's ***learning*** and deprivation would help it. Thus, we have:

Definition: PRINCIPLE

Deprivation

- Withholding a reinforcer
- increases its effectiveness.

Of course, we mean that it increases the ***relevant*** *learning and performance*; we mean

- the learning of a response reinforced by the reinforcer that's been withheld,
- and the tendency to perform a response previously reinforced by the reinforcer that's been withheld.

We say *the reinforcer has caused* ***learning*** if the contingent delivery of that reinforcer in the past causes the response to occur more frequently now.*

* Note that the real test of the past reinforcement is to stop reinforcing present responding and see if the response occurs frequently anyway—at least until extinction wipes it out. If the response does occur frequently without present reinforcement,

So when we say *deprivation* ***increases*** *learning and performance*, we mean:

- deprivation at the time of reinforcement increases the impact the delivery of a single reinforcer has on the future frequency of the reinforced response—it increases ***learning***,
- and deprivation at the time to perform that response increases the frequency of that previously reinforced and thus previously learned response—it increases ***performance***.

Note that when we say *performance*, we mean performance of the previously reinforced response; we mean performance before we reinforce the response again.

To put it loosely, "You learn something, and then you can do it, you can perform it." The past reinforcers are what have caused you to learn the response which you can now perform.

Whew, you may need to read over those paragraphs a few times, because this is tough stuff.

Of course, there's also the principle of **satiation**, the opposite of the principle of deprivation.

Definition: PRINCIPLE

Satiation

- Consuming a large amount of a reinforcer
- decreases its effectiveness.

The issue of satiation is tricky too. If Rudolph consumes a large number of food reinforcers in a brief time, that reinforcer will lose its ability to reinforce the response.** So, for a while, food won't act as an effective reinforcer to produce more ***learning***; and also, for a while, Rudolph will

then that high frequency must be due to the past reinforcement, as there is no present reinforcement.

** In earlier editions, we said that satiation occurred because *he'll be "too full" to consume many more reinforces at that time*, and that's true; not consuming the reinforcer can certainly interfere with learning and performance. But even if we tube fed the reinforcer to Rudolph, it'd still be a weak reinforcer because of his satiation with that reinforcer. In other words, satiation not only affects the amount of the reinforcer consumed, but it also affects the effectiveness of that reinforcer, even when it is consumed.

less frequently ***perform*** the lever-press response that has previously produced that food. Note that the satiating effect of food is temporary; the next day (assuming Rudolph hasn't eaten in the meantime), food will again be an effective reinforcer; so Rudolph will again ***perform*** the food-producing lever-press response at the same high frequency he had before his satiating consumption of so much food. In other words, satiation isn't like extinction, where, aside from a little spontaneous recovery, Rudolph will *not* press the lever at the same high frequency he had before the extinction session.

(Pronunciation lesson: We pronounce **satiation** as *say-she-ay-shun*. The verb form is ***satiate***, and we pronounce it *say-she-ate*, as in *Say, she ate a monstrous meal*. English lesson: We use the procedures of **deprivation** and **satiation** to ***deprive*** or ***satiate*** Rudolph with regard to a particular reinforcer. Then he'll be ***deprived*** or ***satiated*** with regard to that reinforcer. Now we're *cool*.)

By the way, why do you think Eve used such tiny reinforcers (1/4 teaspoon of cereal and milk); why didn't she give Jimmy a man-sized teaspoonful?

Because

a. of the satiation principle.
b. she doesn't want Jimmy's learning to get too dependent on cereal.
c. Jimmy doesn't deserve more.
d. of the principle of shaping.

You can get much more learning out of a bowl of puffed wheat and skim milk if you use 1/4-teaspoon-sized reinforcers rather than full-teaspoon-sized ones. Eve wanted to have as many learning trials as possible, before the deadening effect of satiation set in. In our autism centers, we spend a lot of time breaking big Cheetos into smaller Cheetos and cutting whole M&Ms into quarter M&Ms. In other words, satiation is often an unwanted effect of using edible reinforcers, and you can greatly reduce the effects of deprivation by using small sizes of the edible reinforcers.

QUESTIONS

1. The *principle of deprivation*—define it and give an example.
2. The *principle of satiation*—define it and give an example.
3. What's the difference between satiation and extinction,
   a. in terms of how you'd do it?
   b. and in terms of the effect it'd have on behavior?

EXPERIMENTAL ANALYSIS OF BEHAVIOR IN THE SKINNER BOX

Satiation

OK, you've made sure Rudolph the Rat has been deprived of water for 23 hours before each session in the Skinner box, and all has gone well: He rapidly learned lever pressing; and now, when you put him in the box, he presses the lever at a good clip—several times a minute, getting a drop of water immediately after each press. But when you come into the animal colony room one Monday morning, you find. . . *Hey, who forgot to take the water bottles off the rats' home cages?!* Rudolph's been drinking his fill for the last few days; so now when you put him in the Skinner box, he barely contacts the lever, pressing it only five times in the whole session, not even bothering to lick the water dipper two of those times.

1. This is an example of
   a. deprivation
   b. satiation
2. In this case, what did satiation hurt?
   a. learning
   b. performance

Or consider this teaching tragedy: Suppose your lab instructor had failed to remove the water bottle from the rats' home cages for the first few lab sessions of the semester, when you were just starting to work with Rudolph. (Hey, it happens.) How effective do you think would be those few reinforcers Rudolph did bother to drink?

3. In this second case, what did satiation hurt?
   a. learning
   b. performance

Let's put it this way: You'd probably learn all there is to know about behavior analysis and earn your PhD degree before satiated Rudolph learned the lever press.

If you are fortunate enough to have a rat to work with, you have probably seen the effects of satiation toward the end of your experimental sessions. As Rudolph is nearing his limit of satiation, his frequency of lever pressing will go way down.

QUESTION

1. Give two examples from the Skinner box—
   a. one, the effects of satiation on performance;
   b. the other, the effects of satiation on learning.

Example of Satiation
Behavioral Special Education

JIMMY, THE CHILD WITH AUTISM[1]—PART XII

"What do you want, Jimmy? Hey, doesn't this look like some yummy food? Mmmmm, why don't you ask for it?"

Jack Lewis was sitting at the kitchen table with his son, Jimmy. In front of Jack was a big plate of food. And in front of Jimmy was a little binder with Velcro strips across the cover. Attached to the Velcro were four little laminated picture cards. The pictures on these cards corresponded to the four different foods on the plate in front of Jack.

"Honey," Amy Lewis said to her husband, "why don't you let him take a break for a bit, and you can take a yummy bite, too."

"If you say so, dear," Jack replied. "He's being stubborn right now anyway; he won't ask for a single bite of food."

Before Amy lays down the hammer of reason, let's back up a bit. The binder with little pictures cards (icons) on the cover is part of the Picture Exchange Communication System (PECS).[2] The husband and wife team, Andy Bondy and Lori Frost, developed this system in 1985 to give nonvocal* people a way to communicate. They continue to refine and promote their system today. The basic concept is simple enough—each icon can be thought of as a word that we would speak. But instead of saying the word "juice" vocally, the person using PECS will pick up the picture of juice and hand it to someone. Handing the picture over is the equivalent of saying *I want juice*. Behavior analysts call this type of behavior a **mand**, and everyone else calls it a *request* or *demand*. This is not the only type of verbal (communicative) behavior PECS can be used for, but it's the most common.

"I know you've had a long day honey, but let's think about this logically. We just had dinner an hour ago, maybe Jimmy just isn't hungry for peas, carrots, potatoes, or chicken? Isn't that a better explanation than him just being stubborn? Remember at the PECS workshop they said the motivating operation is one of the most crucial parts of PECS."

Amy was right, of course. Jimmy had earned his clean-plate ranger badge earlier that evening by finishing his entire meal. He was satiated on those healthy foods. And because he was *satiated*, his *performance* of the PECS mand had greatly decreased.

"Good point, as always," Jack said. "I forget that the motivating operation is constantly changing. He did so well asking for food this afternoon that I figured he would do just as well tonight."

Why did Jimmy ask so quickly and correctly for food this afternoon? If you said it was because he hadn't eaten since lunch, and that was 4 hours ago, you'd be right. He was in a state of food **deprivation**, which greatly increased his *performance*.

"That's okay, we're all learning as we go along," Amy said. "But if you want to help him practice with PECS, I do have a bottle of a new kind of juice in the fridge. And I just printed him an icon for it this afternoon. But we didn't get a chance to use it."

Juice is another **unconditioned reinforcer**, and because the Jimmy hasn't had anything to drink in a while, especially anything sweet, he should be sufficiently *deprived* to ask for it. And because he has never used this particular juice icon before, its use needs to be *learned*. The **motivating operation** will have an effect on that learning.

Although this example used only unconditioned reinforcers, PECS can also be used to mand for conditioned reinforcers.

Oh yes, and under Amy's watchful eye, Jack did succeed in teaching Jimmy to exchange the new icon for little sips of the juice. A little father–son Bondying never hurts.

Habituation

So we've discussed **satiation** with a *positive* reinforcer, but what about *negative* reinforcers? We don't say you *satiate* with an aversively loud noise; instead, you ***habituate*** to the loud noise or the excessive cold or heat, at least to some extent you *get used* to it, you habituate to it. And as you habituate, you'll work less hard to escape it. (Incidentally, you'll also notice it less and whine about it less).

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* Important distinction—vocal and verbal do not mean the same things. Vocal means using your mouth and vocal cords to make a sound. Verbal implies "communication," to be a little vague and mentalistic. Sending a letter is verbal behavior, but it's not vocal behavior. And whistling to yourself in the car is vocal behavior, not verbal behavior. But a lot of the time you have both, what we call "vocal verbal behavior," or talking.

QUESTION

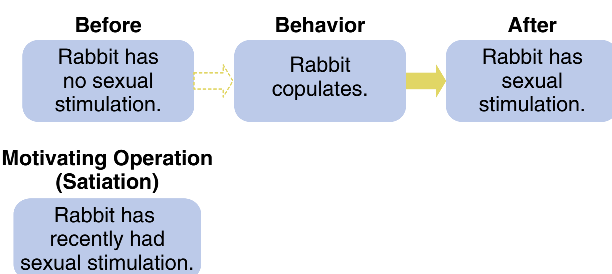
1. Give an applied example showing
    a. how satiation affects performance.
    b. how deprivation affects performance.
    c. how deprivation affects learning.
    d. how habituation affects performance.

Example of Satiation Comparative Psychology

SEX[3]

If you put a male and female rabbit together, what's the first thing they'll do? Have sexual intercourse, of course! Haven't you heard the expression *to copulate like a pair of rabbits*? And what's the second thing they'll do? Have sexual intercourse. And the third? And the fourth? What a life. Within the first hour, the rabbits may mate 15 times.

How long can they keep it up? Sometimes for over 17 hours. Does that make you feel inadequate? Well, don't feel too bad; the first hour was their hour of glory. It'll take them another 5 or 10 hours before they accumulate 15 more matings. In other words, they wait longer and longer between each mating, until they finally get down to a more human pace. That's the effect of **satiation**.



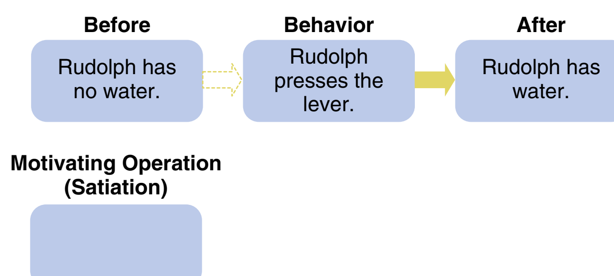
1. What is this decrease in the frequency of copulation an example of?
    a. deprivation
    b. satiation
    c. neither
2. In this example, the satiation effect decreases what?
    a. learning
    b. performance
    c. nothing

More Comparative Psychology

SATIATION, DEPRIVATION, AND THE EFFECTIVENESS OF REINFORCEMENT CONTINGENCIES

For a principle like the principle of satiation to be basic, it usually must apply to a wide variety of situations and often a wide variety of species. No problem with satiation. The more water a rat has recently drunk, the less effective water will be as a reinforcer in learning a new response. And also, the more water a rat has recently drunk, the lower the frequency of the rat's performing that previously learned response; for example, while performing that response, longer and longer periods of time pass between lever presses that are reinforced with water, because Rudolph has had more and more water to drink—he's getting full.

Please complete the following diagram:

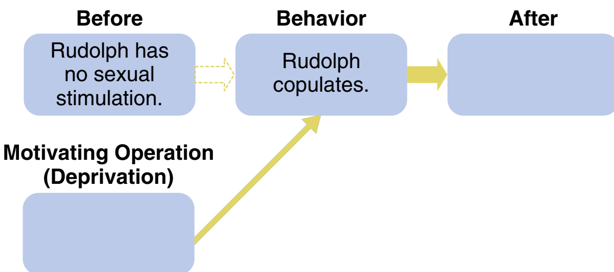


The same thing happens with the pigeon's food-reinforced key-peck response. And check out your rate of shoveling it in, as you approach the end of a pig-out. You'll find your food-reinforced shoveling response gets slower and slower as you eat your fill.

Satiation doesn't last forever—fortunately—for rabbits, rats, pigeons, or people. Sexual stimulation, food, and water eventually regain their original effectiveness as reinforcers. In other words, if we stop giving the reinforcer for a while (deprivation), we reestablish the effectiveness of that reinforcer.

Up to a limit, the greater the deprivation (time without the reinforcer), the more effective the reinforcer. Several days after complete satiation, sexual stimulation for a rat will again be an effective reinforcer to support learning a new response; and the rat will again perform previously learned responses that have resulted in sexual stimulation in the past. It takes much less deprivation for the rat to recover from the effects of satiation with food and water.

Please complete the following diagram:



QUESTION

1. Please diagram a Skinner box example of:

a. *deprivation*
b. *satiation*

Concepts

MOTIVATING OPERATIONS (B-12)

Notice that the procedures of deprivation and satiation both affect the learning and the performance with respect to a particular reinforcer. We'll learn faster and then work harder if we're deprived than if we're satiated. This raises the more general concept of *motivating operations*. Note that **motivating operations (MOs)** are operations that can not only increase our motivation, like **deprivation** can, but they can also decrease our motivation, like **satiation** can. **MOs** that increase effectiveness we call **establishing operations (EOs)**. And **MO**s that decrease effectiveness we call **abolishing operations (AOs)**.

Definition: PROCEDURES

Motivating operation (MO)

- An operation that affects the effectiveness of
- a reinforcer.*

Establishing operation (EO)

- An operation that **increases** the effectiveness of
- a reinforcer.

* In other words, it affects the frequency of the behaviors that result in that reinforcer. And, of course, that reinforcer is, itself, a stimulus, event, or condition.

Abolishing operation (AO)

- An operation that **decreases** the effectiveness of
- a reinforcer.

Of course, a motivating operation increases a reinforcer's effectiveness only when that motivating operation is in effect. For example, food deprivation will make food a more effective reinforcer while Rudolph is deprived. But once the deprivation is removed, once he's satiated, the food will no longer be an effective reinforcer; but we know you understood that, without our telling you! Just being careful.

And, as you also know, a motivating operation will affect Rudolph's "motivation" to perform a response he's already learned using that reinforcer. So when we say a *motivating operation affects the effectiveness of a reinforcer*, we not only mean it affects the reinforcer's effectiveness in training new behavior; but we also mean the motivating operation affects the effectiveness of a history of reinforcement with that reinforcer; we mean it will affect the frequency of behavior that's been previously reinforced by that reinforcer. In other words, motivating operations affect both learning and the tendency to perform what's been learned.

Deprivation and satiation are the most common examples of **motivating operations**. But here are some other examples of motivating operations that affect water as a reinforcer: heavy exercise, high temperature, and consumption of salty foods. Each of these can lead to dehydration, which will increase the reinforcing value of water. Motivating operations affect a wide variety of reinforcers, not only in the lab, but also in everyday life.

A note on our diagrams: In the Jimmy and Rudolph examples we have included another box in the contingency diagram. The box below the before condition includes any relevant motivating operation, like satiation and deprivation. Aside from this chapter, we will not typically be including the motivating operation box in our diagrams, but that doesn't mean there isn't one in effect. To highlight the other important parts of the diagram, we will *not* focus on the MO; but in each example, you will probably want to consider how the MO might affect it.

The Mainstream Approach to Motivating Operations

We've defined motivating operation, as simply as possible, in the hopes that our definition will make your life a little easier; but out in the real world of behavior analysis, it'll get a little more complex. So this little section is just for those of you who plan to venture out into that world.

We say *a* ***motivating operation (MO)*** *affects the effectiveness of a reinforcer*. And we see that effectiveness in terms of

- the MO's effect on learning a new response with that reinforcer and
- the MO's effect on the tendency to perform the response that's been learned with that reinforcer.

Dickinson[4] says:

- The MO increases or decreases the reinforcing effectiveness of a stimulus, object, or event.

The same as we say:

- The MO's effect on learning a new response with that reinforcer.

And Laraway et al.[5] say:

- The MO influences the capacity of operant consequences (reinforcers and punishers) to alter the strength of future behavior.

Again, the same as we say:

- The MO's effect on learning a new response with that reinforcer.

Also, Dickinson says the other effect of the MO is to

- increase or decrease the current frequency of relevant behavior.

The same as we say:

- The MO's effect on the tendency to perform the response that's been learned with that reinforcer.

And Laraway et al. say:

- The MO changes the current strength of behaviors related to the consequences affected by the MO.

The same as we say:

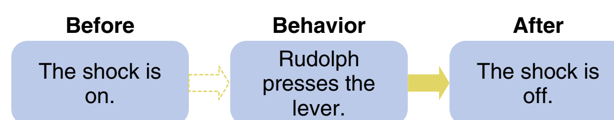
- The MO's effect on the tendency to perform the response that's been learned with that reinforcer.

We hope that if you go back and forth over this a few times, it may make a little more sense.

The Reflexive Motivating Operation

Often, satiation and deprivation don't apply to negative reinforcers such as electric shock, for example, in a negative reinforcement contingency. The relevant motivating operation for negative reinforcers, such as shock, is simply turning on the shock (presenting the negative reinforcer), not deprivation or satiation. And, in those cases, it makes sense to treat the motivating operation and the before condition as the same thing. So you wouldn't diagram a separate box for the satiation or deprivation variable; instead, you'd simply indicate the shock is on in the before condition, and that would also serve as the motivating operation. On the other hand, we might consider increasing the intensity of the electric shock in the establishing operation and decreasing it in the abolishing operation. And on still another hand, habituation to the negative reinforcer could be an abolishing operation. A motivating operation for a negative reinforcer is called a ***reflexive motivating operation***.*

Reflexive Motivating Operation



SATIATION, DEPRIVATION, AND THE EFFECTIVENESS OF NEGATIVE PUNISHMENT CONTINGENCIES

Though rarely studied, deprivation and satiation should also affect learning and performance involving the removal of a positive reinforcer in a negative punishment contingency. For example, I have the obnoxious tic of sort of hunching my shoulders and stretching my neck. Now suppose my friends decided that whenever they were having a meal with me and they saw Dick tic, they would withdraw my humble bowl of brown rice for 60 seconds—a time-out, a negative punishment contingency, temporary removal of a food reinforcer.

And suppose it had been a long time since I'd had anything to eat—serious **deprivation**. Then that negative punishment

* When discussing the *reflexive motivating operation*, generally it is not discussed in the context of the most basic contingency, a simple negative-reinforcement contingency. Instead it's discussed in terms of the warning stimulus in a cued-avoidance contingency. The warning stimulus has been paired with the negative reinforcer that follows it, so that the warning stimulus becomes a conditioned negative reinforcer and is called a ***reflexive conditioned motivating operation (CMO-R)***.

contingency would be very effective. My frequency of tics would **rapidly decrease**, and it would decrease to a very low level.

On the other hand, suppose I had just knocked off a bowl of Uncle Dickie's Marathoner Rolled Oats only a few minutes before my monitored meal—serious **satiation**. Then that negative punishment contingency would not be as effective. My frequency of tics would only **slowly decrease**, it might not decrease to a very low level. In other words, just as with reinforcement contingencies, deprivation should improve the effectiveness of negative punishment contingences and satiation should decrease the effectiveness of such contingencies, with regard to both learning and performance.

So the motivating operations for negative punishment are deprivation and satiation of the positive reinforcer being removed. (Sorry if all these *positives* and *negatives* in the same sentence are making your head spin, but that's just the way life is—life can be head spinning.)

QUESTIONS

1. Define and give an example of
   a. *motivating operation*
   b. *establishing operation*
   c. *abolishing operation*
2. Give an example showing how a motivating operation can influence
   a. the learning of a response
   b. the performance of a response
3. Give an example of a *reflexive motivating operation*.
4. Give an example of an establishing and an abolishing operation for a negative punishment contingency.

THE QUANTITY AND QUALITY OF POSITIVE AND NEGATIVE REINFORCERS

In working with Jimmy, generally, the greater the amount of the reinforcer, the more effective its contingent delivery in producing learning. But you soon reach the point of diminishing returns; further increases in the amount of the reinforcer don't produce much of an increase in the amount of learning; however, increasing the amount of the reinforcer does increase the amount of satiation and thus decreases the number of learning trials Mae and her staff can conduct with Jimmy. That's why the best general strategy seems to be to keep those reinforcers small, but not too small—about the size of a dime for food reinforcers. In our work with kids we use the mini-M&M candies, and we even cut our Skittles in half. And we certainly don't give a handful of sweets for each response. (But it can be a delicate balance between decreasing the size of the reinforcer to reduce satiation and losing the effectiveness of the reinforcer as we reduce its size.)

Similarly, the quality of the reinforcer can be an important feature in determining the extent to which that reinforcer will affect learning and performance of what's been learned. For example, not all foods are created equal. Which do you think would be a more effective reinforcer for you, a fudge sundae or boiled cabbage?

And the same thing applies to negative reinforcers. The more intense the negative reinforcer (aversive stimulus), the more quickly Rudolph or you and I will learn the response that escapes that negative reinforcer. (Sorry, we don't really have an example of the quality of a negative reinforcer, ah maybe a string of insults, some might be more insulting than others. Use your imagination. And, by the way, I used to call messing with the quantity and quality of the reinforcers *incentive operations*, but it never caught on.)

QUESTION

1. Please give an example of the effects of
   a. quantity on the effectiveness of a positive reinforcer
   b. quality on the effectiveness of a positive reinforcer
   c. quantity on the effectiveness of a negative reinforcer
   d. quantity on the effectiveness of a negative reinforcer, if your imagination will take you that far (this one's just for cool points)

A Reminder:

THE DON'T SAY RULE

This is only marginally related to motivating operations, but I can't resist: Don't say Rudolph will immediately start pressing the lever on Tuesday because he *knows* he'll get water for pressing the lever. And don't say Rudolph will immediately start pressing the lever on Tuesday because, on Monday, he *learned that* he would get water for lever pressing.

So what should you say? You should simply say Rudolph will immediately start pressing the lever on Tuesday, because lever pressing was reinforced on Monday. And you could add that he was deprived of water on both Monday and Tuesday, if you want to tie in with the theme of this chapter.

But you should also be careful about saying that Tom makes smart-ass remarks because he *knows* he'll get attention for making smart-ass remarks. Similarly, you shouldn't say it's because he's *learned that* he'll get attention for smart-assing.

So what should you say? Again, you should keep it simple. Tom will smart-ass frequently because a few dumb asses have reinforced that behavior in the past.

True, Tom might know what the contingency was that's caused him to make smart-ass remarks, but the odds are he doesn't; in fact, the odds are he doesn't even know most people consider him a smart-ass and that's why he has so much trouble getting dates. We usually stumble through life oblivious to the contingencies controlling our behavior, even the large set of our behavior that combines to define what people consider our "personality." Amazing, isn't it? And maybe unfortunate, too.

QUESTIONS

1. What should and shouldn't you say when talking about Rudolph learning to press the lever?
2. Cool point for an original example of what you should and shouldn't say about contingencies creating your own "personality."

Example

AGGRESSION[6] (B-12)

Pain-Motivated Aggression

Human Being

Sid, the model man about the house, stood at the workbench in their basement, whistling a tune as he nailed together a wooden planter for Dawn. He was getting good—only three blows of the hammer to drive in each nail. And then, thud—one of his powerful blows hit his thumb instead of the nail. "#$%!" Sid shouted, throwing the hammer against the wall.

"What's the matter, honey?" Dawn asked through the basement door.

"What the @#$! do you think's the matter? It's your %$#! planter. That was the dumbest %#! idea you ever had!"

Rats

Two rats sit in a single box, a box much like a Skinner box but without a response lever and with those ominous metal rods making up a grid floor. By now, you've come to anticipate research involving aversive electric shock when you see that grid floor. Sure enough, a mild shock occurs. But this is no punishment experiment. And there's no negative reinforcement lever for the rats to press. Instead, the rats immediately stand up on their hind legs and face each other like a pair of boxers. But, as they start to attack, the electric shock goes off. They fight briefly and then settle back down on all fours. The same sequence repeats itself every time the shock turns on. (Note: This is not a negative reinforcement contingency; the shock immediately turns off to minimize the amount of harmful fighting the rats do.)

Research of this sort came from the laboratories of Dr. Nathan Azrin, when he was at Anna State Hospital. He and his colleagues showed that every species of animal they tested would aggress against other animals or even objects when they received painful stimuli such as electric shock.

When they received the aversive shock, the rats aggressed against each other. When he received the aversive thumb smash, Sid aggressed against the wall with his hammer or against his hammer with the wall (whichever), and he aggressed against Dawn and the world with his swearing.

Extinction-Motivated Aggression

Human Being

Some of Sid's most reinforcing moments come when he purchases new software, installs it on his computer, and starts testing it, glancing only briefly at the new manual as he does so. (He's always broke because he buys so much software. Such is the life of a computer junkie.) And today is one of those days. He's been in his study with his new software for 3 hours. Suddenly, Dawn hears pounding fists, as Sid shouts his ever-familiar "#$%!"

Against her better judgment, Dawn sticks her head inside his study. "What's the matter, honey? Having trouble with your new program?"

"'What's the matter, honey!' You know #$%#! well what's the matter. Why do I have to be the one who does all the work getting our new software running? Why don't you do your share? That's what I'd like to know. This is the stupidest #$% program I've ever seen. And they might as well not have bothered translating the documentation from the original Japanese. #$%! This is frustrating!"

Extinction city!

Pigeons

Another Skinner box also contains two animals—pigeons—but there's no sign of electric shock, just a response key and a grain feeder. What's strange is that one pigeon sits restrained in a small box in the corner of the larger Skinner box. Only its head sticks out from the restraining box. The free pigeon ignores its restrained friend. Instead, it pecks the key and then eats the grain that is available for 3 seconds after each response. (What kind of schedule of reinforcement is that? Continuous reinforcement.) The bird works peacefully awhile, and then the food stops coming. No matter how hard or fast it pecks the key, nothing happens.

Extinction city!

What does the bird do? It does what Sid did. It turns on its friend and viciously attacks it. The free bird pecks the innocent friend with its beak and hits it with its wings.

Analysis

We've looked at two cases of human aggression and two of animal aggression. Now let's tie it all together; let's put it in a broader behavior-analytic framework.

Warning: What follows is a theoretical analysis, an interpretation of the data; so not everyone will agree with it.

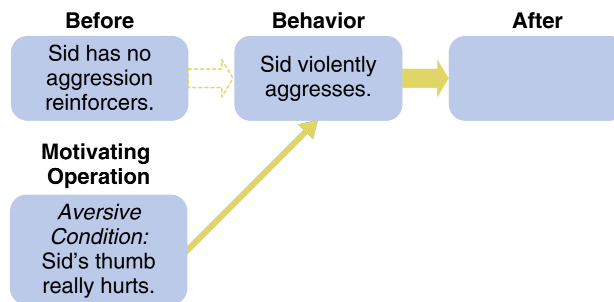
Sid's aggression follows a smashed thumb, and the rats' aggression occurs during electric shock—in both cases, aggression during painful stimulation. Also, Sid's aggression occurs during the failure of key presses on the computer to produce its customary reinforcers; and the pigeon's aggression occurs during the failure of key pecks in the Skinner box to produce its customary reinforcers—in both cases, aggression during extinction.

No doubt, painful stimulation is an aversive condition. And maybe extinction is too. Now the traditional analysis would say an aversive condition (a negative reinforcer or extinction) automatically produces the aggressive response (throwing, swearing, attacking). But let's look at it from the point of view of motivating operations. We might say an aversive condition is a motivating operation that affects learning and performance with respect to the **aggression reinforcers**. Normally, Sid doesn't throw things or swear, and normally animals don't attack members of their own species. This aggressive behavior usually occurs only when an aversive condition (a negative reinforcer or extinction) establishes the results of aggression (what we will call *aggression reinforcers*) as reinforcing.

1. So how would we apply this analysis to our earlier examples of Sid's pain-motivated aggression? Please complete these diagrams.

Human Being

Pain-Motivated Reinforcement Contingency

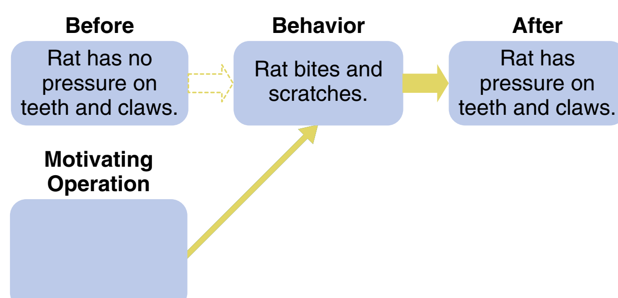


We think the aggression reinforcers in this case are the feel of throwing the hammer (proprioceptive* stimuli), the sound of its hitting the wall, and the feel and sound of shouting. Plus, for some reason it seems to be most reinforcing when those shouts are swear words!

2. Now please apply our analysis to the earlier example of the rat's pain-motivated aggression by completing this contingency diagram.

Rat

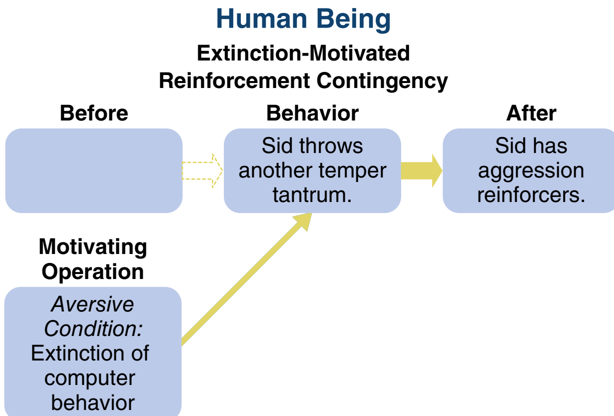
Pain-Motivated Reinforcement Contingency



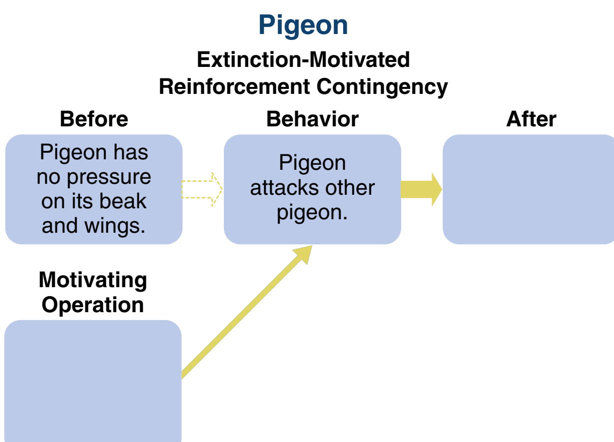
Note that pressure on teeth and claws are examples of what we mean by *aggression reinforcers*.

3. And please apply our analysis to the earlier example of Sid's extinction-motivated aggression by completing this contingency diagram.

* pro·pri·o·cep·tor (próprê-o-sèp´ter) *noun*. A sensory receptor, found chiefly in muscles, tendons, joints, and the inner ear, that detects the motion or position of the body or a limb by responding to stimuli arising within the organism. [Latin *proprius*, one's own + (re)ceptor.]—pro'pri·o·cep'tive *adjective*. (*The American Heritage® Dictionary of the English Language*, Third Edition. Copyright © 1992 by Houghton Mifflin Company. Electronic version licensed from INSO Corporation. All rights reserved.)

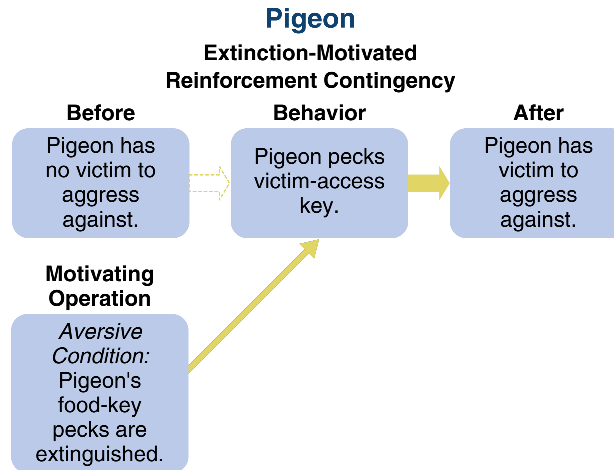


4. And also please apply our analysis to the earlier example of the pigeon's extinction-motivated aggression by completing this contingency diagram.



Of course, you're skeptical. The aggression response seems so natural it's hard to imagine reinforcement playing a role. Fortunately, Drs. Azrin, Hutchinson, and Hake tested this out.

In a follow-up experiment, they put a second key in the Skinner box and temporarily removed the restrained pigeon from the Skinner box. As before, a schedule of continuous food reinforcement maintained the pecks on the food key during the first phase. Then, in the second phase, the frustration phase, the experimenters extinguished pecks on the food key. But now there was no restrained victim bird to aggress against. However, each time the aggressor bird pecked the new key (victim-access key), the restrained victim bird was put back in the Skinner box for a brief period. What happened? The aggressor pigeon pecked the victim-access key during extinction, got the restrained victim bird, and attacked it! And during continuous food reinforcement, it ignored the victim-access key.



So this shows that access to the victim bird was a reinforcer for the aggressor bird during its time of frustrating extinction. And it doesn't require much of a leap of faith to assume that the reason access to the victim bird was a reinforcer was that the aggressor bird could then aggress against it. And, in turn, this suggests that the stimuli arising from pecking on the victim bird were effective aggression reinforcers that were reinforcing that aggressive pecking. In other words, the reason the aggressor aggressed was because that aggressive behavior produced reinforcers, the aggression stimuli.

But the experimenters didn't stop there. A schedule of continuous reinforcement had maintained pecking the access key; in other words, each peck brought the restrained bird back to be the victim of more aggression. But, in the third phase of their experiment, the experimenters used a fixed ratio of 70; in other words, the aggressor bird had to peck the victim-access key 70 times before the experimenters would put the restrained victim bird back in the Skinner box. The results? During food extinction (frustration), the aggressor bird reliably pecked away at the victim-access key until it had knocked off the 70 responses and got its victim. Indeed, the opportunity to aggress was a powerful reinforcer! We think that's just another way of saying the stimuli resulting from aggression are powerful reinforcers—for example, the proprioceptive and tactile stimuli (touch stimuli) the bird gets when it pecks and hits.

In summary, negative reinforcers and extinction are motivating operations. They function as motivating operations to affect learning and performance with respect to the reinforcing stimuli produced by aggression. Such negative reinforcers increase the speed of learning aggressive behavior and the frequency of the performance of such behavior. (Aggression-produced stimuli would include the pressure on the pigeon's beak when it aggressively pecks another bird, the pressure on a rat's teeth when it attacks another rat, and the pressure on a man's fist when he smashes it into the wall in a fit of rage.) Let's further summarize, with a couple of definitions:*

Definition: CONCEPT

Aggression reinforcer

- A reinforcing stimulus resulting from acts of aggression.

Definition: PRINCIPLE

Aggression principle

- Negative reinforcers and extinction are motivating operations
- for aggression reinforcers.

What are the stimuli resulting from acts of aggression? They are fairly clear in the case of physical aggression: pressure on the rat's teeth and gums as it bites the other rat; pressure on the beak of the dove of love and peace as she pecks violently at her friend; pressure on Sid's fist as he pounds violently on the workbench. These are strange reinforcers, but we suggest they are the reinforcers that maintain that aggressive behavior. The rat doesn't bite thin air, nor does the dove peck thin air, nor does Sid smash thin air. In other words, stimulation resulting from violent physical acts tends to be an aggression reinforcer.

If this physical stimulation is so reinforcing, why don't we aggress all the time? Because the motivating operation is often missing. Like all reinforcers, the aggression reinforcers need a motivating operation. In the case of these reinforcers, the motivating operation is the presentation of aversive stimulation (a negative reinforcer) or extinction.

* Response blocking might be another motivating operation for aggression reinforcers. For example, suppose that each time a rat runs down a runway, it gets a food pellet. Then suppose that one time you put a barrier near the end of the runway that prevents the rat from continuing toward the food. That's called *response blocking* and will act as a motivating operation for aggression reinforcers. But that may be only a special case of extinction of the running response, so we haven't added response blocking to our definition. We might similarly interpret physical restraint, or physical restraint may simply be a negative reinforcer in its own right, though it is also a form of response blocking.

What about verbal aggression; what are the aggression reinforcers there? That's a good question. Unfortunately, we know of no research on this topic. People swear aggressively even when there's no one to hear them. And they swear in their own language, not a language they don't know. So this form of aggression requires an elaborate learning history. However, it's not clear what that history is. But it sure seems universal.

Is letting off steam or letting out the energy generated by frustration (extinction) an aggression reinforcer? Letting off steam and letting out energy are just metaphors. We're not steam engines. And we don't build up energy as a result of extinction. There is no such *thing* as frustration; it's not a substance inside us that builds up and must be released. It's a poetic metaphor for extinction, making aggression reinforcers more effective. The problem with these poetic metaphors is that people act as if they were real. So that sort of metaphorical analysis tends to encourage aggression in a way that may harm the person and the person's friends and family. In other words, it's not OK to allow Jimmy to aggress against people and objects so he can "let off steam, or let out energy, or express his inner hostility." There's no evidence that aggression has a "mental health" benefit for the aggressor, in spite of the common assumption that it does. And, on the other hand, it is clear that aggression is usually harmful and dysfunctional, whether it's Jimmy or Sid throwing a temper tantrum. Our advice: Don't aggress and don't tolerate aggression; it's bad business in a civilized society, even if it is reinforcing.

QUESTIONS

1. Diagram an experiment that shows pain-motivated aggression.
2. Diagram an experiment that shows extinction-motivated aggression.
3. Diagram an experiment that shows that the opportunity to aggress can be a powerful reinforcer.
4. *Aggression reinforcer*—define it.
5. *Aggression principle*—define it.

Example

SUBTLE AGGRESSION

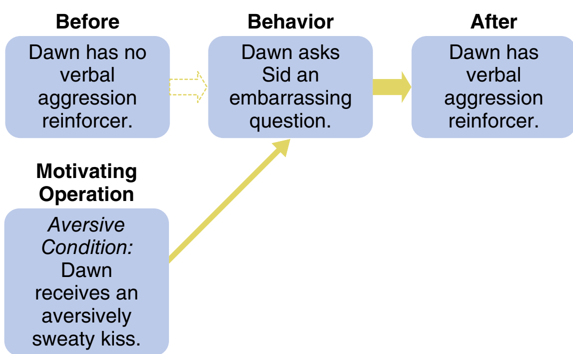
Dawn slept in that Sunday morning, not feeling too well because of a sore throat. But Sid got up and went for a 1-hour, 6:00 A.M. jog, long and slow—relaxing. When he got back she was up, so he gave her a sweaty kiss; he was so happy to see her, but he worried his perspiration may have made the kiss more of a negative reinforcer than a positive reinforcer for her.

Sid started to describe the pleasure of his jog, the beauty of the rising sun, the freshness of the early morning air. Sharing these delights with Dawn was a reinforcer. But then he thought, "No, she finds it aversive when I manage to do more running than she does."

Discreetly wiping the sweaty kiss from her lips, Dawn asked, "What do you plan to do today?"

Sid said, "I think I'll go to the library and check out a few more references for my dissertation."

She asked, "Don't you have enough references? Aren't you just procrastinating? Aren't you just avoiding the aversiveness of doing the hard part—the writing?"



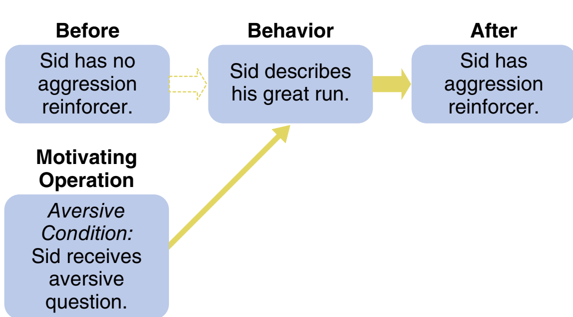
He said, "Yes, you're right." But his tone suggested he didn't enjoy her accurate behavioral analysis.

"Honey, are you angry with me for saying that?" she asked.

"No, you're right," he replied.

"But I'd rather be married to a man without a PhD than divorced from one who has a PhD."

"No, no, I appreciate your pointing out that I was avoiding the hard stuff. By the way, I had a great run today; the rising sun always gets me going, and the crisp morning air feels so good. I got in a solid 6 miles."



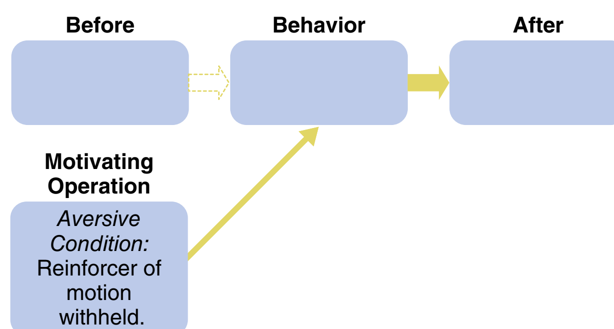
Whoops. Sid allowed a little aggression to fall on his wife, knowing, as he did, that his describing the run she hadn't participated in made her feel inadequate.

Aversive stimulation establishes aggression as a reinforcer almost too sweet to resist, especially when you can make the aggression so subtle the victim barely detects that it's happening. The victim can't put a label on it, can't point an accusing finger. And better yet, even the perpetrator of the aggression can't self-criticize because the aggression is too subtle even for him or her to detect it. In other words, often we're not only unaware of why we aggress, but we're even unaware that we are aggressing.

A mother goose and her young goslings were strolling across the road, at peace with the world, until a battered green Honda Civic sped around the curve. Sid hit the brakes and the horn at the same time.

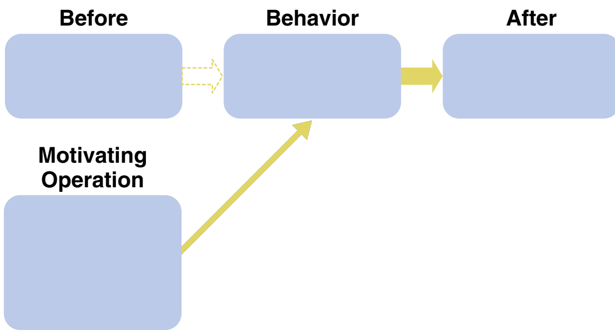
"#$%! those birds," he said. "They crap up the sidewalks, they wake me up with their honking, and now they're going to make me late for my lecture."

1. Diagram this example of Sid's obvious aggression.



Dawn thought, "Poor Sid, the tiniest interruption in the flow of his normal reinforcers, and he loses his cool." His profanity-aggression reinforcers get hold of him. But she said, "Sid, honey, they're so cute"—a form of mild aggression on her part, the production of mild guilt in Sid. She aggressed because it was aversive for her to listen to Sid's blast of the horn and his rant against those harmless animals. (Dawn's statement was aggressive in that it caused Sid some mild guilt by suggesting that he wasn't completely justified in his anger at the *cute* little birds.)

2. Diagram this example of Dawn's subtle aggression.



Pigeons peck at other pigeons until it hurts, and people verbally zap other people until it hurts. (One reviewer thought this example was a little lame, because the kind of subtle aggression he experiences involves slamming doors and drawers, giving abrupt answers, and then when asked if anything is wrong, giving the terse reply, "No, everything's dandy." And that's true, but often my experience has been that subtle aggression is so subtle that we're unaware that it's happening, even though those aggression reinforcers are controlling our behavior.)

There are also situations where we aggress even more subtly, to the point where the aggressor is the only one who can detect it. We might call this *covert aggression*. You curse under your breath as you walk away from the boss who just told you to come into work on Saturday. You certainly don't curse to her face, but you end up with an aggression reinforcer only slightly milder than the one you'd get if you'd cursed to her face. In this case, the higher-quality aggression reinforcers you would have received for being more overt are overpowered by the potential punishers for overt aggression. So you settle for the lower-quality aggression reinforcers resulting from your covert behavior.

QUESTION

1. Diagram three cases of subtle aggression.

AGGRESSION REINFORCERS

Aggressive behavior is common in children and adults with autism, other developmental disabilities, and closed-head brain injuries, occurring at some level in about 15% of the individuals receiving treatment. So far in this chapter we've seen how pain, extinction, and other negative reinforcers can lead to aggression. One of the primary goals when dealing with aggression from anyone is to find its function, so we can use an appropriate intervention.

We think aggression often starts because of the sort of automatic aggression reinforcers we've been considering, and we think those aggression reinforcers also help to maintain the aggression. But often behavior like hitting, throwing, or biting will result in contact with additional reinforcement contingencies. What would most of us do if we approached someone who tried to hit, bite, or scratch us? We'd probably back off and give that person some space. And what if the person came up to us and started aggressing? We might try to figure out the problem, asking the person what was wrong and providing comfort. Or we might show something interesting to distract the person. And because we provide all these different reinforcement contingencies for the aggressive behavior, that aggression might start to come under the control of one of these additional contingencies; the aggression might gain a different function. Consider Jimmy for an example:

"I can't believe Jimmy bit me today. I must be the worst mother in the world for my child to hate me that much," Amy Lewis said to her classmate and confidant, Sofia.

"Oh Amy, you know that's not true," Sofia replied. "Would the worst mother in the world be going to grad school at night to figure out how to help her son?"

"Maybe not, but I don't think Jimmy cares. He just gets so mad sometimes, and I don't feel like the things I'm asking him to do should be such a big deal."

"Well, why don't you tell me what's happening, and maybe the two of us can brainstorm some solutions," Sofia said.

The budding behavior analysts put their heads together and started problem solving. In the last couple of months, Jimmy had started to bite and hit. Just once in a while at first, but lately it was becoming more frequent, and more troubling. It happened in different situations, but there were a few times when Amy knew it would happen. The most reliable involved Jimmy's way of playing with his toy trains. Like many people with autism, Jimmy had some ritualized or stereotyped ways of doing certain things, including playing with trains, one of his favorite kinds of toys. He had so many little trains that Amy and Jack had lost track of the number. All the Lewises' friends and relatives knew Jimmy loved trains, so when they visited, they usually brought him a little toy train. But he didn't play with the trains in a typical manner. Instead, he would line them up in certain ways or park them all in a specific order.

But even more than his own trains, Jimmy loved his dad's special antique toy train. Mr. Jack Lewis's father had hand crafted a toy train for him when Jack was a little boy himself. This toy had held a special place in his heart, especially since his father had passed away, and it rested in a special place on their mantle. But as far as Jimmy was concerned, this was the king train. It held a special place at the head of his lines of trains. And that was OK with everyone, until a few months ago when one of the wheels on the special train had snapped off as Jimmy was playing with it. After that, the train was off-limits.

Off-limits doesn't mean that Jimmy stopped trying to get it, though. He was pretty good at scaling the fireplace to reach up and snatch the toy. But now, Jack was adamant about preventing further damage to *his* train, so he blocked or removed access to the train whenever he saw Jimmy going for it. He was interrupting or preventing one of his son's most consistent stereotyped behaviors—a situation where aggression was most likely to occur. After being blocked or having the train taken away, Jimmy would yell and start to hit and scratch his dad.

"What happens after he aggresses toward your husband?" Sofia asked.

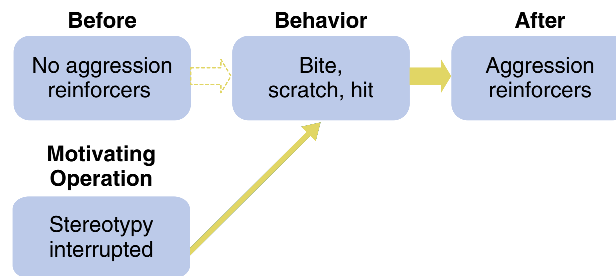
"Well, Jack normally holds his ground. He doesn't want Jimmy to break the train, so he'll either take the train out of the room for the day or he might make Jimmy leave the room. But because Jack is at work most of the day, I'm the one who actually catches Jimmy."

When Amy was the one to see her son going for or already playing with the train, she would try to keep the train safe too, because she knew how much it meant to her husband. And Jimmy would aggress against her as well, more hitting and pinching, and even the occasional bite.

"I do my best to stay firm when that happens, but sometimes I just can't do it. Jimmy gets so visibly upset and violent that sometimes I can't handle it, and I give him the train to calm him down. I know I shouldn't, but it's hard to understand how difficult that is unless you are in the moment. . . . So, do you have any ideas?"

"I have a few thoughts," Sofia replied. "We both know that one reason aggression occurs is because it produces aggression reinforcers. In this case, I think it's the prevention or interruption of his stereotypy that's the motivating operation for aggression.

"But I also stumbled on an aggression article by Murphy and colleagues and even though the specific situation looks quite a bit different, I think the same principle's at work. Murphy's group reported that aggression occurred most reliably when a strong behavioral chain, or ritual, was prevented from being completed. Maybe that's what's happening with Jimmy, too. But I think what's making his aggression even more likely is that it's intermittently reinforced by gaining or regaining access to the ritual item, the toy train."



"That makes sense," Amy said. "The aggression may have occurred the first few times just because it produced aggression reinforcers during an aversive situation. And he still gets those aggression reinforcers every time. But now he also occasionally regains access to the train and can continue his stereotypy, and that's increasing the aggression even more."

"Exactly," Sofia said. "But the good news is that Murphy's team found that if you can consistently prevent the stereotypy from occurring, the person has time to learn other more appropriate behaviors. It won't be easy to deal with the aggression, and it might get a bit worse before it gets better, but I think it will be worth it."

A Behavior-Analytic Theory of Aggression

Is Aggression Behavior Learned?

Our position is controversial, but we argue that aggressive **behavior** is learned. Suppose an animal is being aversively stimulated or its behavior is being extinguished. Then it will learn more or less any arbitrary response, if that response produces an aggression reinforcer. When a monkey's tail is shocked, it bites a rubber tube because that biting response is reinforced with aggression reinforcers—pressure on its teeth, gums, and jaws.[7] Roger Ulrich and his students demonstrated this pattern of behavior in 1969. But if the apparatus were so rigged that gently pulling a string would produce those aggression reinforcers, we think the monkey would learn to gently pull the string as its aggressive behavior. That's just like human beings learning to be gentle and quiet in their sarcastic aggression. What *is* unlearned, innate, or inherited is the reinforcing value of pressure on the monkey's teeth, gums, and jaws when being aversively stimulated (e.g., tail shocked). Great reinforcers for you and me, too, when someone's shocking our tail. You've heard about biting the bullet?*

So what we're saying is that all of us learn aggression **behavior** because that behavior produces aggression **reinforcers**. But the aggression reinforcer, itself, is an unconditioned, innate reinforcer. It's just as if Rudolph, a rat in a Skinner box, learns to press the lever because that behavior produces a drop of water. And the water reinforcer, itself, is an unconditioned, innate reinforcer. Lever pressing is a learned response, and water is an unconditioned reinforcer. Also, aggression is a learned response; and the aggression reinforcer is an unconditioned reinforcer.

Ulrich and his students went one step further toward proving the arbitrary nature of aggression by punishing the shock-induced aggression with more shocks. Punishing the hose biting decreased it. But interestingly, some of the monkeys found other ways to get aggression reinforcers after hose biting was suppressed; for example, they started biting their fingers or sides, or even clawing at their own faces. The monkeys were still producing aggression reinforcers but avoiding topographies that were punished with more shocks.

What's the Value of Aggression?

In the environment where our species and most others evolved, aggressive behavior kept other animals from taking food away from our ancestors (aggression reinforcers kick into action when other reinforcers are interfered with—extinction [a.k.a. frustration]). You don't believe us? Google "Never take a bone away from a dog."

Also, our ancestors evolved in an eat-or-be-eaten world. If another animal attacked one of our ancestors, the painful attack was a negative reinforcer, and great-great-great- . . . grandmother would be more likely to survive if that stimulation acted as a motivating operation to support her aggressive behavior. And those aggression reinforcers are still kicking in for us, even though now they may do more harm than good—most of the lions and tigers are in zoos now. Our ancestors are long gone, but not their susceptibility to aggression reinforcers.

I'm saying that we don't come factory wired with the tendency to aggress, but we do come factory wired with aggression reinforcers easily established by aversive conditions. And those aversive conditions are occasions where aggression might have aided survival, at least for our ancestors.

Why Isn't Success in Battle Enough of a Reinforcer?

Wouldn't we learn aggressive behavior simply because such behavior allowed us to escape the painful stimuli of an attack? Maybe, but the learning might be too slow. We might have been someone else's meal before we had the opportunity to learn to fight well enough to survive. But if every time we happened to hit or bite or swing actively, such aggressive behaviors produced an aggression reinforcer, then those effective fighting responses would probably be learned more quickly than if we had to execute a successful battle plan and escape the pain of the attack before that sequence of behaviors would be reinforced and thus learned.

By the way, we're not saying that negative reinforcement contingencies aren't also operating. No doubt escape from the negative reinforcer of a predator's bite will add more reinforcement for the aggression behavior. And, it may be that the skills of fighting aggressively will be shaped by quicker and quicker escapes. But we are saying that we think such a negative reinforcement contingency wouldn't do the trick by itself; there needs to be an initial level of aggression behavior automatically reinforced by the aggression reinforcers.

QUESTIONS

1. Is aggression **behavior** learned?
   a. learned
   b. unlearned (innate)
2. Please explain your answer.
3. Are the aggression reinforcers conditioned or unconditioned?
   a. conditioned
   b. unconditioned (innate)
4. Please explain your answer.
5. What is the value of aggression?
6. Why isn't success in battle enough of a reinforcer?

* While the origins of the phrase "biting the bullet" are not clear, one possible explanation relates to our point in this section. The story goes that the phrase comes from the battlefield practice of biting down on a bullet (or leather strap, for example) when in great pain, such as during a medical procedure in the midst of battle without anesthetic. This certainly could have produced some aggression reinforcers, which might have distracted the soldier from the pain he was helpless to escape.

Example

DRUG ADDICTION[8]

Much mysticism and moral indignation surrounds drug addiction and the drug addict. Many people consider drug addicts to be morally flawed; either they have some mysterious spiritual weakness or some mysterious genetic weakness—the infamous type-x genetic pattern. But let's consider a more behavioral approach.

Q: What's the first question you ask when you begin a behavior analysis?
A: What's the response?

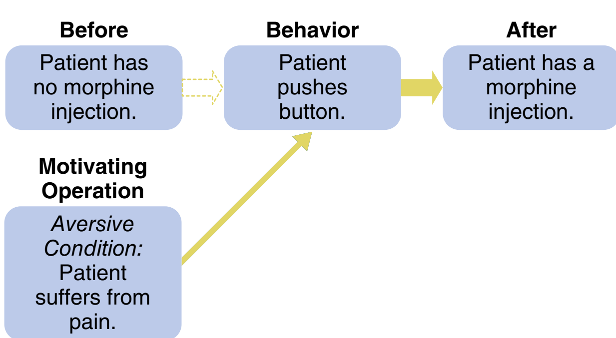
Q: Good. What's the main response of interest in drug addiction?
A: The self-administration of a drug.

Q: Good. Your second question?
A: What's maintaining the behavior? What's the positive or negative reinforcement contingency?

Q: Good. Give me a relevant example of a negative reinforcement contingency.

Negative Reinforcement—Pain

A patient in a hospital suffers terrible pain. If she pushes a button, morphine automatically starts dripping into her bloodstream through an intravenous tube. The morphine reduces the pain.

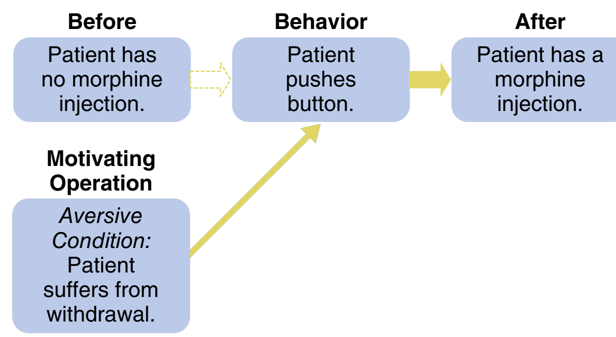


How about another example?

Negative Reinforcement—Withdrawal

We've talked about the consumption of morphine as a negative reinforcement response. What does that have to do with addiction?

One feature of addiction can be physical dependency. The patient is permanently cured of his pain and stops pressing the button for the morphine. But then he starts having aversive physical withdrawal symptoms from the morphine. Another dose of morphine comes to the rescue with the press of the button, wiping out the withdrawal symptoms—at least for a while.



The withdrawal negative reinforcement contingency is just like the previous pain contingency, except for one thing—the motivating operation. The past consumption of the morphine is part of the motivating operation that produces the aversive withdrawal symptoms.

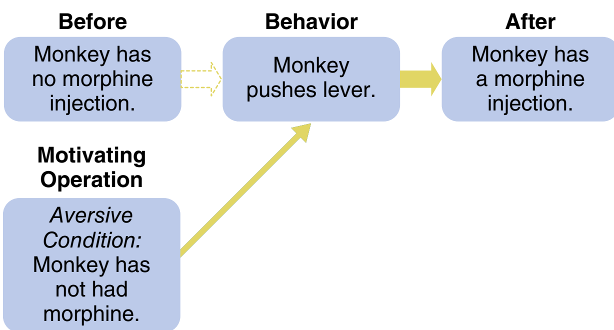
The Pure Pleasure of Drugs

People are more sympathetic to drug addicts if they think addicts take the drug because it reduces pain or because it reduces the harshness of poverty. But they tend to get morally indignant if they think addicts take drugs for the fun of it—in other words, because it's a positive reinforcer. So in behavioral terms, here's one of the big drug debates: What maintains drug abuse, the presentation of a positive reinforcer or the reduction of a negative reinforcer?

Put another way, is suffering an aversive condition, an essential motivating operation for the learning and performance of drug-reinforced behavior? And, as we'll see, the answer is *no*.

Dr. Travis Thompson, Dr. Robert Schuster, and their students and colleagues have done much animal research on drug addiction. They've found that addictive drugs are unconditioned reinforcers prior to addiction. This includes morphine, heroin, codeine, and cocaine. In other words, a monkey will press a lever if the lever press produces a shot of morphine. And the monkey need not be suffering any physical stress or be physically addicted to the drug. All these drugs are unconditioned reinforcers. So an aversive condition and negative reinforcement contingency are not essential for morphine or heroin to act as a reinforcer controlling learning and performance.

But that's not the whole story. As we said, if the monkeys keep taking morphine over a prolonged period of time, they will become tolerant to the drug; in other words, they will need increasingly larger amounts of the drug to produce the same physical effects. And withdrawal of the drug for a day or so can produce physical distress. Complete withdrawal sometimes leads to death.



Thompson and Schuster presented two motivating operations that were effective for morphine. First, they showed that deprivation of morphine acted as a motivating operation. In most of their research, the monkeys were deprived of morphine for only 6 hours. But, even so, they'd press the response lever at a moderate rate, as long as an occasional lever press produced an immediate shot of morphine. But when they were deprived of morphine for 24 hours, they'd press the lever at a tremendous rate. In other words, morphine works like most reinforcers: The more deprivation of the reinforcer up to a point, the higher the frequency of performance of the response that has been previously reinforced with that reinforcer.

They also checked out nalorphine. This drug is a derivative of morphine, and it reverses the activity of morphine and other narcotics in the nervous system. Because of its properties, it can counteract an opioid overdose and is sometimes used to find out if a person is addicted to morphine. Morphine addicts will show withdrawal symptoms if they receive a shot of nalorphine. Thompson and Schuster's monkeys were addicted. (If given the opportunity, monkeys will consume enough morphine to become physically dependent.) And when they received a shot of nalorphine, the monkeys acted as if they had been deprived of morphine for some time, even though they had not. In other words, their rate of lever pressing greatly increased. This means an injection of nalorphine is another motivating operation; it increases the frequency of performance of the response previously reinforced with morphine.

Let he who is without sin cast the first stone.

—Jesus Christ

DANGEROUS DRUGS CHECKLIST
Check here. I use:

- **Heroin**
- **Morphine**
- **Cocaine**
- **Speed**
- **Barbiturates**
- **Alcohol**
- **Marijuana**
- **Rock and Roll**
- **Nicotine**
- **Caffeine**
- **Processed sugar**
- **Table salt**
- **Animal fat**
- **Netflix**

Let he who is not stoned
cast the first criticism at addicts.

—Richard W. Malott

QUESTIONS

1. Fill out the contingency diagrams for three negative reinforcement contingencies involving addictive drugs. They differ mainly in their motivating operations.
2. Describe an experiment demonstrating that drugs can maintain self-administration through reinforcement other than escape from a negative reinforcer.
3. Describe the research on nalorphine as a motivating operation.

Concept

ADDICTIVE REINFORCERS

As behavior analysts, we generally don't label people. Here's one reason: When you label people as drug addicts or alcoholics, you tend to fall back on the so-called spiritual and genetic causes of behavior. And this almost always means you end up blaming the victim—the addicts. You end up saying they just don't have the right stuff, either spiritual or genetic. Instead, we behavior analysts work hard to find the causes in the behavioral contingencies rather than in the person. This behavior-analytic approach may be superior, both morally and practically.

As a behavior analyst I'm less inclined to talk about addicts and more inclined to talk about *addictive behavior* or, better yet, **addictive reinforcers**. The behavior tends to be arbitrary. In the Skinner box, it can be pressing the response lever; in the hospital, it can be pushing the button that starts the intravenous drip; on the "street," it can be tying a belt around your arm and sticking a hypodermic needle in a vein. So we should emphasize addictive reinforcers rather than addictive behaviors.

Definition: CONCEPT

Addictive reinforcer

- A reinforcer for which
- repeated exposure
- is a motivating operation.

In considering addictive reinforcers, keep in mind that addictive drugs are unconditioned reinforcers even before they become addictive reinforcers—even before their repeated use has acted as a motivating operation to increase their value as reinforcers. But addictive reinforcers differ from most unconditioned reinforcers, like food; the repeated eating of food doesn't increase food's value as a reinforcer (food was a very strong reinforcer from day one).

Opiates are the religion of the masses.

—Richard W. Malott

Can you think of any other addictive reinforcers?
What about nicotine and caffeine?
All our wonderful, modern drugs?

QUESTION

1. *Addictive reinforcer*—define it and give an example.

Notes

1 Inspired by Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18,* 111–126. For this edition, we have changed some of the details about Jimmy to help the examples flow from chapter to chapter, but the basic concepts are the same, as well as the principles behind Carr and Durrand's intervention.

2 Bondy, A., & Frost, L. (1994). The picture exchange communication system. *Focus on Autism and Other Developmental Disabilities*, *9*, 1–19.

3 Based on Rubin, H. B. (1967, December). Rabbit families and how they grow. *Psychology Today*, 50–55; Bermant, G. (1967, July). Copulation in rats. *Psychology Today*, 53–61.

4 Dickinson, A. M. (2017). *Motivating operations/establishing operations*. Manuscript.

5 Laraway, S., Snycerski, S., Michael, J., & Poling, A. (2003). Motivating variables and terms to describe them: Some further refinements. *Journal of Applied Behavior Analysis*, *36*, 407–414.

6 Based on Azrin, N. H., Hutchinson, R. R., & Hake, D. F. (1966). Extinction-induced aggression. *Journal of Experimental Analysis of Behavior, 9,* 191–204. For years, traditional psychologists have talked about frustration-producing aggression. This may be the world's first animal experiment on frustration-produced aggression.

7 Based on Ulrich, R., Wolfe, M., & Dulaney, S. (1969). Punishment of shock-induced aggression. *Journal of the Experimental Analysis of Behavior*, *12*, 1009–1015.

8 Based on Poling, A. (1986). *A primer of human behavioral pharmacology*. New York: Plenum Press; and Thompson, T., & Schuster, R. (1964). Morphine self-administration, food reinforcement and avoidance behaviors in rhesus monkeys. *Psychopharmacologia, 5,* 89–94.

PART VIII

Stimulus Control

CHAPTER 14

Basic Stimulus Control

Behavior Analyst Certification Board 5th Edition Task List		
B-10.	Define and provide examples of stimulus control.	Throughout
B-11.	Define and provide examples of discrimination, generalization, and maintenance.	Throughout
B-14.	Define and provide examples of the verbal operants.	Pages 270–274
G-2.	Use interventions based on motivating operations and discriminative stimuli.	Throughout
G-4.	Use stimulus and response prompts and fading (e.g., errorless, most-to-least, least-to-most, prompt delay, stimulus fading).	Page 271
G-10.	Teach simple and conditional discriminations.	Throughout

Concepts

BEHAVIORAL ANIMAL TRAINING

Discrimination Training Based on Positive Reinforcement (G-2) (G-10)

The pistol pointed directly at Keller Breland's head. He breathed deeply and stood his ground. The gun was mounted in a frame with one end of a string attached to the trigger. A live chicken held the other end of the string in its beak. If the chicken pulled the string, the gun would fire and the bullet would pierce Breland's head. After standing motionless for several seconds, Breland stepped aside. The chicken immediately pulled the string, and the bullet entered the bull's-eye of the target behind the spot where Keller Breland had stood. Breland pulled a few kernels of corn from his pocket and fed them to the chicken. Only then did he wipe the perspiration from his forehead.

Breland was one of Professor Skinner's first grad students. He became famous as an animal trainer, using reinforcement to do such things as train chickens to roller-skate and play baseball and train pigs to do four-brassiered strip-tease acts. Breland wanted the chicken to fire the gun only when he was not in front of the target, as he didn't want to become behavior analysis's first martyr.*

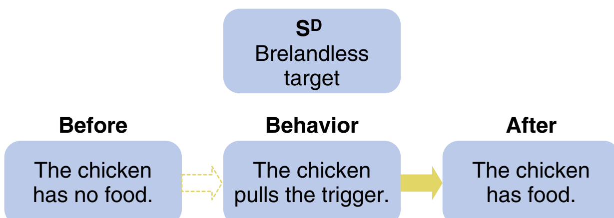
You suspect that the kernels of corn reinforced the chicken's response of pulling the trigger. And you're right. "But," you may ask, "why didn't the bird shoot the gun when Breland was in its line of fire?" Your first reaction might be that the chicken was chicken, but we trust you wouldn't say anything that corny. Your second reaction might be that if the chicken had done so, Breland wouldn't have been able to feed it. However, it would be an error of mentalism to imagine that the chicken restrained herself for fear of "killing the behavior analyst who laid the golden kernels."

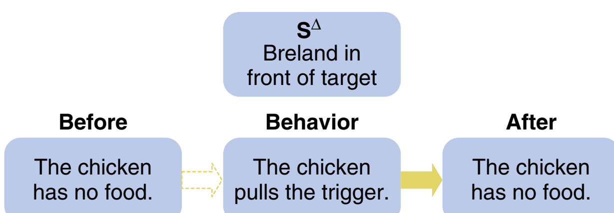
In previous chapters, we talked about reinforcement and extinction. We used reinforcement to increase the frequency of a behavior and extinction to get rid of a behavior. Now we want to add stimuli to the procedures of reinforcement and extinction. So, if in the presence of a target without Breland standing in front (stimulus), firing the gun (response) results in kernels of corn (reinforcer), then in the future, the firing response will occur more frequently in the presence of the Breland-**less** target: REINFORCEMENT. In the same way, if in the presence of Breland (stimulus), firing the gun (response)

* When Marian Breland confirmed the truth of this section, we found that Keller Breland had used a toy popgun instead of a real one, but the principles we illustrate are the same.

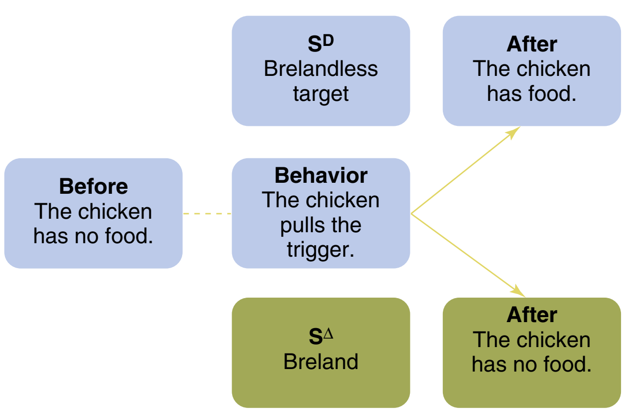
does not produce kernels of corn, Breland's presence will make firing less frequent in the future: EXTINCTION.

We call the Brelandless target the **discriminative stimulus (S^D)** and Breland the **S-delta (S^Δ)**. In this case, a *discriminative stimulus*, or S^D, causes a response because when that stimulus was present in the past, the response produced a reinforcer. The S^Δ makes a response less frequent because when that stimulus was present in the past, the response didn't produce a reinforcer. (You pronounce S^D "ess dee," and you pronounce S^Δ "ess delta.")





To make the role of the stimuli clearer, we diagram these contingencies together, as follows:



Definition: CONCEPT

Discriminative stimulus (S^D)

- A stimulus in the presence of which
- a particular response will be reinforced or punished.

It's crucial to understand that this definition of S^D implies there is an S^Δ in the presence of which that response will less frequently be reinforced or even punished.*

Definition: CONCEPT

S-delta (S^Δ)

- A stimulus in the presence of which
- a particular response will not be reinforced or punished.

Notice the following properties of our diagrams of discriminative contingencies.

- They are really two contingencies, an S^D and an S^Δ contingency.

* By the way, notice that in this book our definitions of S^D and S^Δ are procedural definitions. That means we define them in terms of the procedures used—in this case, in terms of the presence or absence of a reinforcement contingency. In our definition, we don't say anything about whether the organism makes the specific response in the presence of S^D. In other words, whether or not the S^D and S^Δ exert effective control over the behavior of the organism is not relevant to our procedural definition. Your professor may choose to add the following tag line to our definition of S^D: *and in the presence of which that response will be more likely or less likely to occur*. Whether the response will be more or less likely to occur depends on whether the stimulus is an S^D for reinforcement or punishment.

Here's a more general, though less common, way to define these two concepts: Reinforcement or punishment is more likely in the presence of the S^D and less likely in the presence of the S^Δ. In other words, reinforcement need not always occur in the S^D, and it need not always be withheld in the presence of the S^Δ.
When we say *stimulus*, we mean *stimulus condition* or *particular value of the stimulus*. For example, an S^D could be darkness (the light intensity would be at zero); we do not apply a dead-stimulus test, or burnt-out light bulb test.

Finally, what do we mean by *in the presence of* when we define S^D as *a stimulus in the presence of* which a particular response will be reinforced or punished? We apply something like the 60-second test we use in our definition of *reinforcer*. In other words, we'd hate to do discrimination training with Rudolph if the light went off more than 60 seconds before Rudy had a chance to press the lever. It would probably be a fruitless exercise. In fact, we're saying 60 seconds exceeds our meaning of *in the presence of*, so we'd have to call that proposed S^D an analog *S^D* rather than a true S^D. Now, such analog S^Ds can control the behavior of verbal human beings such as you and me, probably because we have rule-governed behavior, as we shall see in the later chapters of this book, but forget it for poor Rudolph.

- The before condition is the same for both contingencies.
- The response is the same for both contingencies.
- The S^{Δ} contingency is always extinction or recovery.

Breland used a **discrimination-training procedure**. This procedure involves reinforcing one behavior in the presence of one stimulus, S^D (the Brelandless target), and extinguishing the behavior in the presence of another stimulus, S^{Δ} (Breland). When the response finally occurs more frequently in the presence of the S^D than in the presence of the S^{Δ}, we say ***stimulus control*** or ***stimulus discrimination*** has occurred. This is what happened with Breland's discrimination-training procedure. Stimulus control began to develop until it was perfect. At the end of training, the feathered sharpshooter never fired the gun when Breland was in its sight and always fired it when he wasn't.

Definition: PROCEDURE

Discrimination-training procedure

- Reinforcing or punishing a response
- in the presence of one stimulus
- and extinguishing it
- or allowing it to recover
- in the presence of another stimulus.

Definition: CONCEPT

Stimulus discrimination (stimulus control)

- The occurrence of a response more frequently in the presence of one stimulus
- than in the presence of another,
- usually as a result of a discrimination training procedure.

Remember: *Stimulus* is singular, *stimuli* is plural, and *stimuluses* is what people say who haven't had the excellent education you're paying a small fortune to get.

QUESTIONS

1. Define the following concepts and diagram an example:

a. discrimination-training procedure
b. S^D
c. S^{Δ}

2. What was the reinforcer for the chicken pulling the trigger in the Breland demonstration?

a. Breland not shot
b. Food

3. Why didn't the chicken pull the trigger when Breland was in the line of fire?

a. Because it might have killed Breland
b. Because that response was not reinforced with food

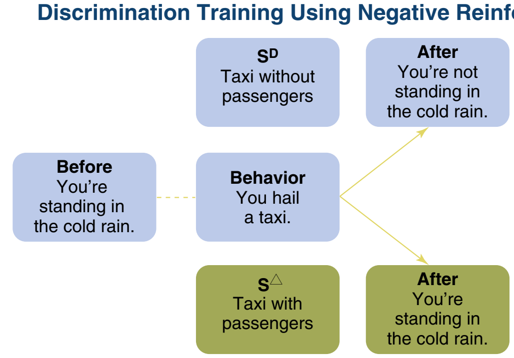
4. *Stimulus discrimination*—state this principle and give an example, showing how it illustrates the principle.

Discrimination Training Based on Negative Reinforcement (Escape)

Five P.M. You're in the chaos of the big city: Everybody's going home from work, traffic flowing in all directions, horns sounding everywhere, people swarming through the streets. You're tired, hungry, cold, 30 miles from home, with no car; and if that weren't enough, it's raining. Oh, did I mention the wind is blowing like mad? How aversive! You see a taxi without a passenger. Desperately, you signal the driver to stop, but someone else signals in front of you. You miss it. Then you see a taxi with two passengers. This time you don't even bother to move. Why? Because a taxi with passengers is an S^{Δ}, a stimulus in the presence of which signaling to stop has not been reinforced in the past. You signal only in the presence of an S^D, a taxi with no passengers, because in its presence signaling usually has caused the taxi driver to pick you up, though not always.

We have just described a discrimination-training procedure involving a negative reinforcement contingency. The response? Signaling the taxi driver to stop. The aversive condition? Few things could be worse than being tired, hungry, cold, and wet. The negative reinforcement contingency? Signaling the taxi driver to stop results in escape from a cold, wet, exhausting city street to the warm, dry comfort of a cozy cab. Finally, signaling the taxi driver to stop is under perfect stimulus control: You signal only when the taxi has no passengers and never signal when it has passengers.

Discrimination Training Using Negative Reinforcement



Notice that we are defining and using S^D and S^Δ not only with positive reinforcement by the presentation of reinforcers but also for negative reinforcement (escape) by the removal of aversive conditions.

QUESTION

1. Diagram discrimination training based on negative reinforcement.

Example

BEHAVIORAL SCHOOL PSYCHOLOGY

Multiple S^Ds and S^Δs: Teaching a Juvenile Delinquent to Read[1]

Bobby Brown had been in the juvenile correction department nine times before he was 15 years old. Like many juvenile delinquents, his prime targets were school buildings. One time he shot out light bulbs and windows in a school with a BB gun. Of course, he smoked, drank, and even got drunk occasionally. He stole, habitually lied, and used language that would make even a fraternity man blush. Bobby came from a long line of juvenile delinquents. He was the fifth of 11 children, and each of his four older brothers had been to the juvenile court for misbehavior.

Home life was far from ideal. His father had completed only the fifth grade of school. His father and mother unsuccessfully tried to control Bobby's behavior by using physical and verbal abuse.

Though Bobby had been in school 8 1/2 years, his reading was still at the second-grade level. Teachers had promoted him from one class to the next class, so they could get him out of their sight. They wanted nothing to do with him. Although no one had been able to help Bobby, two people thought they could. One was William Butterfield, a probation officer from the juvenile correction department. The other was Dr. Arthur Staats, a behavior analyst.

Unfortunately, many people would believe that Bobby was inherently bad, inherently a juvenile delinquent. But Butterfield and Staats didn't think so. Instead, they thought he was an unfortunate victim of his unfortunate circumstances. Any of us would have done what Bobby had done if we had been growing up in similar circumstances.

Also, many people believe we can't help juvenile delinquents because they are fundamentally uncorrectable. But Staats and Butterfield didn't believe so. And fortunately, for several years, Staats had been working in the experimental analysis of reading and had been developing remedial reading programs based on the principles of behavior. So they thought Bobby could learn to read if the instructor used appropriate teaching procedures. They thought reading was a series of discriminated responses that could be learned with reinforcement. (By *discriminated response*, we mean *a response under the control of an S^D*.)

They prepared special stories for Bobby. Each story had a new set of words. The written words were to act as discriminative stimuli for saying those words. Before starting a new story, Butterfield showed each S^D word to Bobby and asked him to make the correct reading response. If Bobby answered correctly, he got a token. Each word served not only as an S^D for the proper spoken response but also as an S^Δ for improper spoken responses. For example, the written word *shoe* was the S^D for the spoken response *shoe* and the S^Δ for *hat* and all other incorrect responses.

When Bobby failed to respond to a word correctly, Butterfield told him the correct response; then Bobby repeated it, looking at the word. Butterfield presented each S^D word over and over until Bobby was able to make the correct response to each of them without prompting.

During the 4 1/2 months Bobby worked with Butterfield, they ran across 761 words that Bobby couldn't read. After their 4 1/2 months, Bobby was able to correctly read 585 of them the first time he saw them in the context of a story.

Bobby got a token when he responded correctly to each S^D word in the paragraph. At that point Butterfield advanced to a new paragraph in the story. When Bobby made a wrong response, Butterfield corrected it and put the paragraph aside to return to later. He did this until Bobby had mastered each paragraph in the story; at that point, the words were exerting proper stimulus control over Bobby's responding.

Butterfield gave Bobby poker chips as tokens. Were the poker chips unconditioned reinforcers or conditioned reinforcers? The poker chips had acquired their reinforcing value because they allowed Bobby to purchase a variety of things. Bobby exchanged the tokens for such items as shoes, hair pomade, a phonograph record, an ice-cream sundae, a ticket to a school function, and money for his brother who was going to attend a reform school.

Bobby worked hard. During the total 40 sessions of reading, he made over 64,000 single-word reading responses. And he got reinforcers worth a total of only $20.31 (in the early 1960s). In addition, with this reinforcement contingency, Bobby was cooperative and attentive—unusual for juvenile delinquents in more traditional instructional programs. A few dollars can go a long way, when properly contingent.

These results support Staats and Butterfield's belief that juvenile delinquents are not fundamentally bad. They behave properly when they are in an environment that reinforces desirable and cooperative behavior. But if they are not capable of making the desirable responses that produce authorized reinforcers, they make undesirable responses that produce unauthorized or bootleg reinforcers.

While Staats and Butterfield taught Bobby to read out loud, they also taught him silent reading. So let's discuss the problem of teaching silent reading. To reinforce the correct reading response to a particular S^D word, it is necessary for the teacher to know what word the student is reading and hear the reading response. This creates no problem in teaching oral reading, but how can the instructor use this method to teach silent reading?

After Bobby had mastered a story at the oral level, Butterfield asked him to read it silently. Butterfield also warned him that it was important to understand the story, because he would be asked questions afterwards.

One of the first things Butterfield and Staats did was to make it likely that Bobby was paying attention to the story. Simply looking at the page was obviously the first step in reading it, a step in the right direction. Therefore, they differentially reinforced the observing response of looking at the page. They did so about every 15 seconds. If Bobby was looking at the page when reinforcement became available, he received a token. It worked. He spent most of his time oriented toward the printed page.

Bobby initially had some trouble with silent reading; he often emitted small vocal sounds and moved his lips. So he got a token whenever he read a story without making any sound or moving his lips. As a result, lip movements decreased.

But it became harder to know whether Bobby was reading each S^D word. So, to ensure he was in fact reading, he had to write out the answer to a set of questions after reading each story. He got a token for each question he answered correctly. Whenever he made a spelling error, he had to correct it before getting the token. And each time he gave an incorrect answer, he was to reread the same paragraph and correct the answer before getting a token.

When Bobby completed 20 stories, he answered a review test on the words he had learned. Again, he got a token for each correct response. And when he responded incorrectly to an S^D word, he had to respond to that stimulus word repeatedly until he responded to it correctly. Bobby was able to read 430 of the 761 S^D words the first time he took a review test.

We can most readily see the effect of training these word discriminations by looking at Bobby's reading achievement test scores. In his 8 1/2 years of school, he had progressed only to the second-grade (2.0) reading achievement. But in 4 1/2 months of this special training, he progressed from the 2.0 to the 4.3 grade level—more in those 4 1/2 months than he had in the preceding 8 1/2 years of school.

Bobby's general performance in school improved almost as much as did his performance on the reading achievement test. He got passing grades in all his courses: *C* in physical education, *D* in general shop, *D* in English, and *D* in mathematics. This may not strike you as anything to be excited about until you look at Bobby's past academic record. In the 8 1/2 years he had been in school, he had failed every course he'd taken.

He also began to behave better while in school. During the first month of training, he committed 10 misbehaviors that warranted demerits: disturbance in class, two times; disobedience in class, two times; loitering, two times; and tardiness, four times. In the second month, he got only two demerits, one for scuffling on the school grounds and one for creating a disturbance. In the third month, he also got two demerits, one for cutting a math class and one for swearing in class. He didn't misbehave in the fourth month or in the half month after when the school term ended.

When writing this present section, I wished I could conclude Bobby's case history at this point. We'd all feel so much better if it had a happy ending. But, unfortunately, the story went on. The training Bobby received improved his grades and his behavior in the school, but that wasn't enough. No one did anything to improve his behavior at the juvenile detention home where he was staying. He often baited the attendants at the detention home and created many minor but aversive disturbances. So he was sent to an industrial school for juvenile delinquent boys. Probably Bobby had not yet reached the point where he could continue his progress without special reinforcement procedures. But Staats and Butterfield were no longer able to work with him. This most likely means that he will make little if any academic progress during the remainder of his school years. Probably Bobby will be a misfit the rest of his unhappy life. Probably he'll do more harm than good both to himself and to society. It's too bad he hadn't had the chance to participate in an Achievement Place group home, rather than a traditional detention home; an Achievement Place home might have saved him. (You read about Achievement Place in Chapters 2 and 9.)

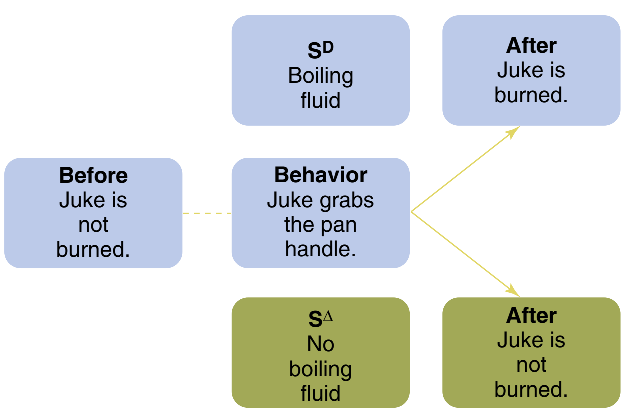
QUESTIONS

1. Using a discrimination training procedure, diagram how Butterfield and Staats taught a juvenile delinquent to read "shoe."
2. And tell us a little more about their complete procedure.

Discrimination Training Based on Positive Punishment

Through an underground network of outlaw health enthusiasts, Juke has learned of an internationally infamous recipe for old-fashioned rolled oats, a recipe said to have originated somewhere in the backwoods surrounding Kalamazoo, Michigan. He's brought to a boil the rich, aromatic mixture of water, apple juice, raisins, bananas, apples, pure vanilla extract, and cinnamon. Now all he has to do is pick up the pan, carry it over to the sink, and dump in 1 1/2 cups of coarse-ground, old-fashioned, non-instant, rolled oats. He grabs the cast aluminum pan handle and, "#—%$!," burns his hand.*

Eventually, Juke will become a seasoned rolled-oats cook. By then, the sight of the fluid boiling in his aluminum pan will be an effective punishment-based S^D. In the presence of that S^D, Juke's grabbing the aluminum handle with his naked hand will always produce a painful outcome. So stimulus control will develop. He'll stop grabbing the hot handle.



* What happened next is not crucial for this section; but if you're interested, Juke finally stopped cursing, took a kitchen knife, went into his solar greenhouse, cut off a piece of an aloe vera plant (one that had grown so big it was about to take his beloved greenhouse from him), sliced it open, and smeared its slimy, green innards over his burning palm. Instant relief. A perfect negative reinforcement contingency: terrible pain, rub a little slimy aloe vera on the painful palm, no pain. So if you'd like to experience a powerful negative reinforcement contingency, next time you accidentally burn or cut yourself, slop on some aloe vera. Give it a shot; you'll be glad you did.

The wiser Juke will now make a testing response. He'll gingerly touch the handle with his index finger. If it's not too hot, he'll pick it up. In other words, a mild temperature on his index finger is a punishment-based S^Δ in the presence of which the burning punishment contingency is not in effect. Of course, a hot temperature on Juke's index finger is another punishment-based S^D.

We know of no other behavioral textbook that discusses the grim issue of stimulus control based on a punishment contingency. But because such stimulus control contributes greatly to keeping our bodies intact, we thought the only honorable option was to call it to your attention.

QUESTION

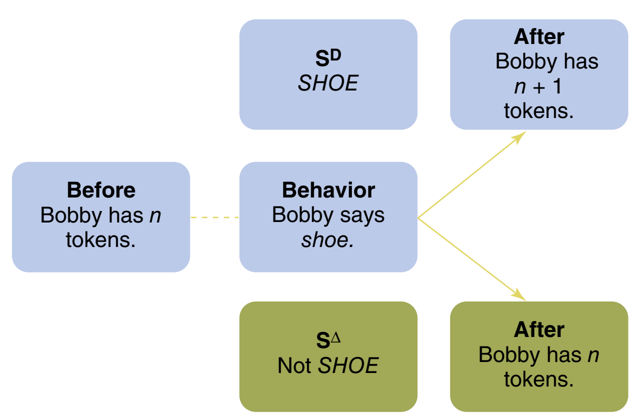
1. *Punishment-based S^D and punishment-based S^Δ*— diagram an example that includes both.

Compare and Contrast

REINFORCEMENT-BASED DISCRIMINATIVE STIMULI VS. PUNISHMENT-BASED DISCRIMINATIVE STIMULI

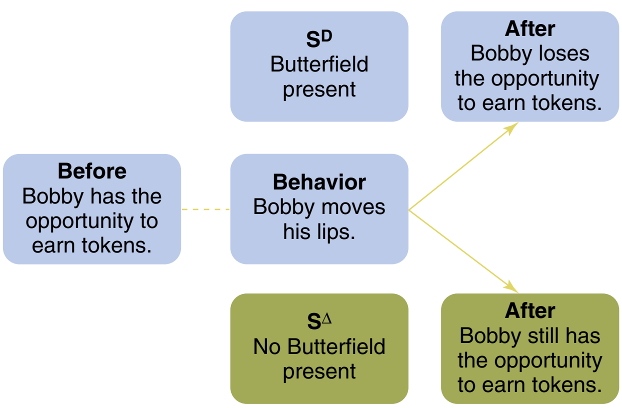
A stimulus that always precedes a positive or negative reinforcement contingency acquires causal functions. This means that in the future, the mere presentation of that stimulus will cause the response. For instance, Bobby said the word *shoe* (response) when he saw a card with the letters *S-H-O-E* (S^D) because in the past, when Bobby did so, he got tokens and praise (reinforcers). As a result of the discrimination-training procedure, the mere presentation of the card caused Bobby to make the correct response. The letters were an S^D based on a reinforcement contingency.

Reinforcement-Based Discrimination



On the contrary, a stimulus that always precedes a positive or negative punishment contingency acquires suppressive functions. This means that in the future the response in that contingency will occur less frequently in the presence of that stimulus. In the presence of Butterfield (S^D), lip movements during silent reading (response) occurred less frequently. Why? Because when Butterfield was around and lip movements occurred, Bobby lost the opportunity to get a token. Losing the opportunity to get a token contingent on lip movements is a special type of punishment contingency, so Butterfield's presence was a punishment-based S^D. A *punishment-based* S^D is a stimulus in the presence of which a response will be punished.*

Punishment-Based Discrimination



But punishment can take place in either of two ways—not only by the removal (or prevention) of a reinforcer but also by the presentation of an aversive condition. So Butterfield's presence also could have acted as an S^D based on the presentation of an aversive condition. Instead of taking away a reinforcer, he could have made an aversive comment each time Bobby moved his lips during silent reading. If so, the frequency of lip movements also would have decreased in Butterfield's presence.

In the same way, you use swear words (response) less frequently when your mother is present (punishment-based S^D), because in the past, her presence always resulted in a sermon (aversive stimulus) about her degenerate kids. And what about when your mother isn't there? A *punishment-based* S^{Δ}—no punishment contingency.

The punishment-based S^D plays the same role with punishment as the reinforcement-based S^D plays with reinforcement. In both cases, these stimuli are associated with the contingency.

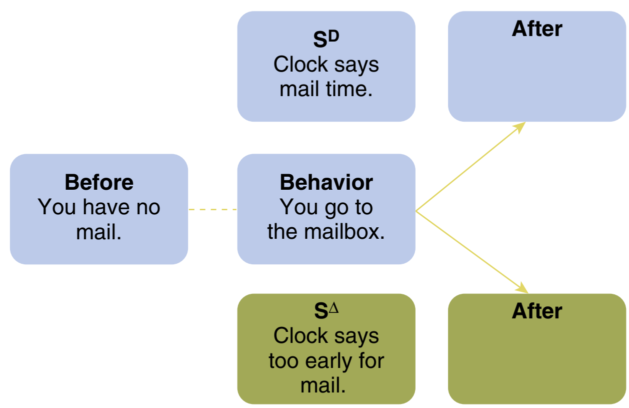
* But on second thought I'm not too sure about this example. How can Bobby earn chips if Butterfield isn't there?

And the punishment-based S^{Δ} plays the same role with punishment as the reinforcement-based S^{Δ} does with reinforcement. In both cases, these stimuli are associated with the absence of the contingency.**

Our behavior is often under the control of combinations of reinforcement-based S^Ds and S^{Δ}s and punishment-based S^Ds and S^{Δ}s. Getting your mail is usually a big reinforcer. So the clock on the wall pointing to the time for mail delivery is an S^D for going to the mailbox. The clock pointing to an earlier time is an S^{Δ}.

Please complete the following diagram.

Reinforcement-Based Discrimination

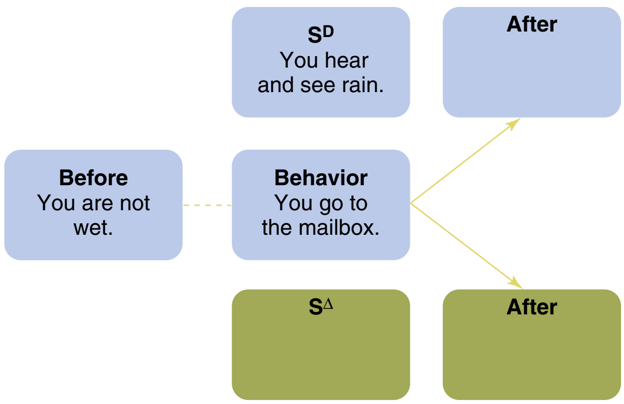


If you live in the country, as I do, the sight and sound of rain are punishment-based S^Ds for going to the mailbox. And a silent, dry lane is a punishment-based S^{Δ}. So you can see how those four stimulus conditions might combine to exert stimulus control over your behavior.

Please complete the following diagram.

** Another way we might define S^D and S^{Δ} that would be consistent with our approach is as follows: S^D—*a stimulus in the presence of which a contingency is operative*. S^{Δ}—*a stimulus in the presence of which a contingency is not* operative. I don't know of any other published source that addresses the terminological problem of S^D and S^{Δ} for punishment (if you do, please let me know). Some prefer to define S^{Δ} as *a stimulus in the presence of which behavior occurs at a low frequency or not at all*. In other words, they would say both extinction and punishment occur in the presence of the S^{Δ}. I think we should generally define our procedural terms in terms of procedure and not in terms of the effects of the procedure, and I think people have a hard enough time distinguishing between punishment and extinction without lumping them together under S^{Δ}; but your professor may disagree, and your professor is always right.

Punishment-Based Discrimination



QUESTIONS

1. What are the similarities between a reinforcement-based S^D and a punishment-based S^D?
2. Diagram an example of reinforcement-based discrimination.
3. Diagram an example of punishment-based discrimination.

In the Skinner Box

COMPARE AND CONTRAST

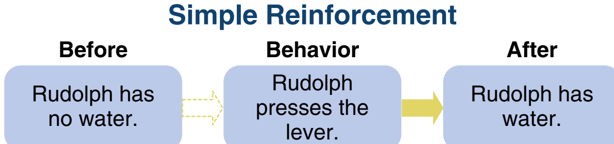
The Differential-Reinforcement Procedure vs. the Stimulus-Discrimination Procedure

Before we compare the differential-reinforcement and stimulus-discrimination procedures, let's look at simple, nondiscriminated, nondifferential reinforcement.

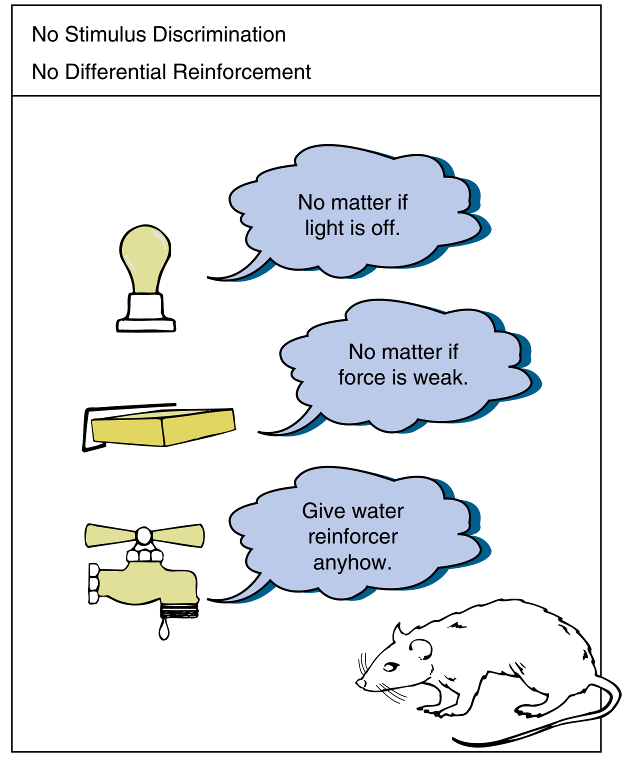
The Nondiscriminated, Nondifferential Reinforcement Procedure

With Rudolph the Rat, we reinforce any lever press, more or less regardless of the force with which he presses the lever. In other words, we're defining the response class in terms of its function (its effect on the environment) moving the lever down.

Simple Reinforcement



Now we're ready to compare the differential-reinforcement and stimulus-discrimination procedures.



The Differential-Reinforcement Procedure

In differential reinforcement, we combine reinforcement and extinction (Chapter 11). We reinforce one response class and extinguish other response classes. So the frequency of the reinforced response class increases relative to the frequency of the unreinforced response classes.

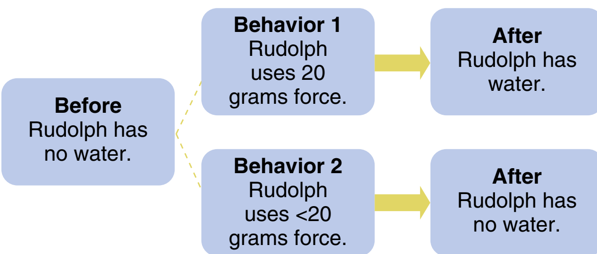
For example, in the rat lab, we start by reinforcing any lever press, more or less regardless of the force with which the rat presses the lever.* In other words, we're defining this initial response class in terms of its function (its effects on the environment—the downward movement of the lever).

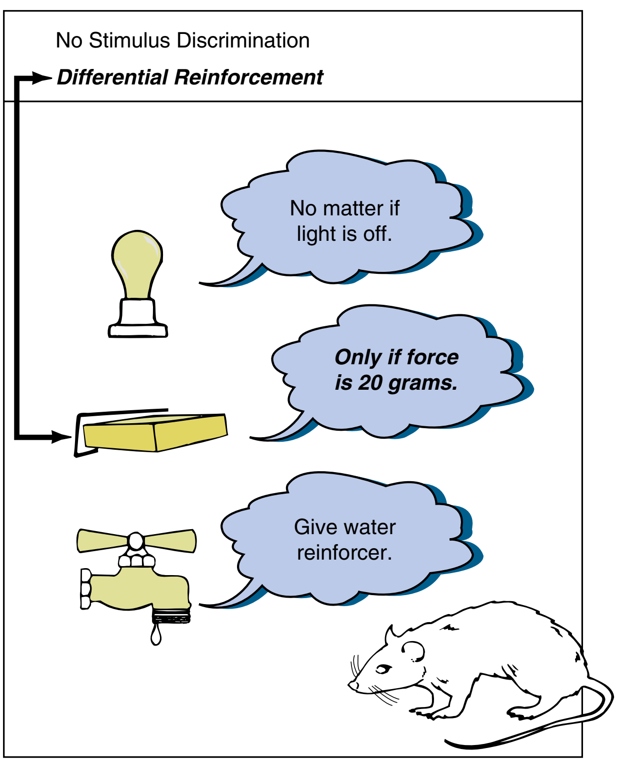
After initial nondifferential reinforcement, we start our differential-reinforcement procedure. Now we reinforce only

* Notice that in saying *more or less*, we're copping out slightly to avoid making a complex topic even more complex. The problem is that whenever we reinforce lever pressing, we are differentially reinforcing along the dimension of force, whether we mean to or not. Here's why: If the rat doesn't use at least enough minimal force, the response won't even budge the lever. So it's impossible to reinforce a response without involving this most basic form of the differential reinforcement procedure. But usually we analyze the contingencies in terms of the differential reinforcement procedure only when we explicitly want to shift the frequency of the response along some response dimension.

those lever presses that occur with at least 20 grams of force. We extinguish less forceful presses. In other words, we divide the larger initial response class into two smaller classes (subclasses). So we've defined the larger response class in terms of a response function—the pressing of the lever. And we've defined the two smaller classes in terms of a response dimension—force.

Differential Reinforcement



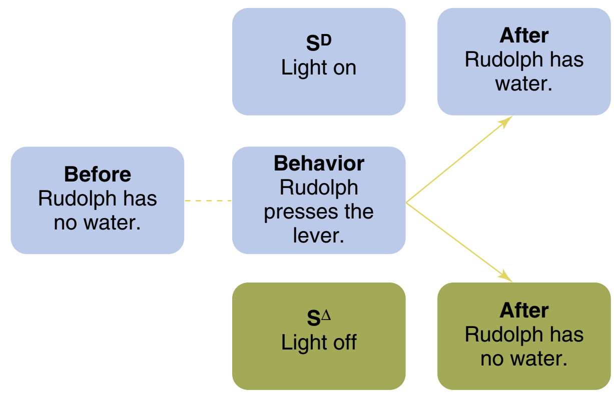


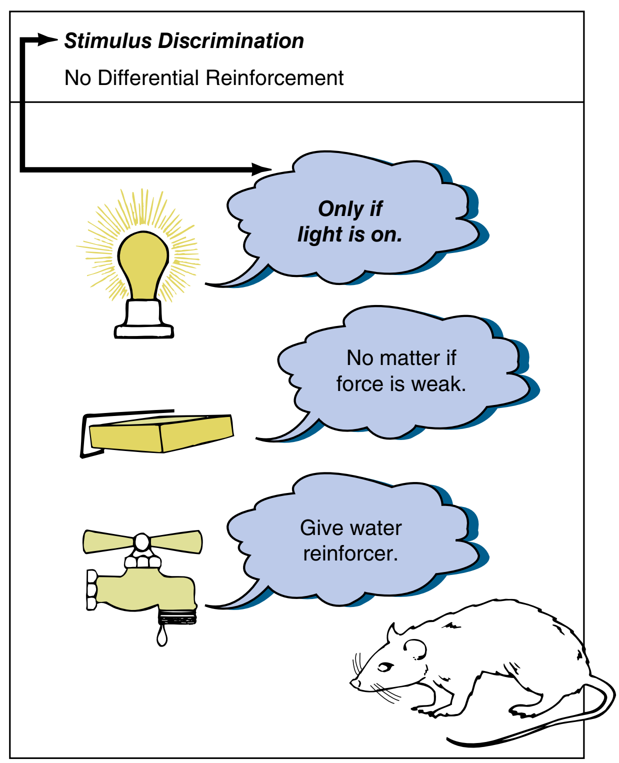
Stimulus-Discrimination Procedure

In the simple stimulus-discrimination procedure, we also combine reinforcement and extinction. But, usually, we deal only with one response class, not two or more response classes, as we do in the differential-reinforcement procedure. For example, in the simple stimulus-discrimination procedure, we deal only with the response class functionally defined in terms of the pressing of the lever.

What we vary in stimulus discrimination is the stimulus; the response remains constant. In stimulus discrimination, we reinforce a response class in the presence of one stimulus and extinguish the same response class in the presence of another stimulus. So, for example, we reinforce the lever press when the light is on (S^D), and we extinguish the press when the light is off (S^Δ).

Stimulus Discrimination





(Now we don't care about the force of the response as long as it's great enough to cause the lever to move down.)

In sum, in our differential-reinforcement example, we use two response classes (responses with a force of 20 grams or more and responses with a force less than 20 grams) and only one stimulus (the light). However, in the stimulus-discrimination example, we use only one response class (lever presses) and two stimuli (light on and light off).

The Differential-Reinforcement Procedure vs. the Stimulus-Discrimination Procedure

	One Stimulus	Two Stimuli
One Response Class	No differentiation or discrimination	Stimulus discrimination
Two Response Classes	Response differentiation	Differentiation and discrimination

Differential-Punishment and Stimulus-Discrimination Procedures Using Punishment

Of course, the same differences apply to differential punishment procedures and stimulus-discrimination procedures using punishment contingencies. For example, in differential punishment the lever press produces shock as well as food if its force is less than 20 grams. But it produces only food if its force is 20 grams or more. (Of course, the light is on all the time.) So the frequency of the lower-force lever presses decreases relative to the frequency of the higher-force lever presses. As with our example of the differential-reinforcement procedure, this example of the differential punishment procedure involves two response classes and one stimulus.

Now consider an example of a stimulus-discrimination procedure based on punishment. The lever press produces shock as well as food if it occurs when the light is off (punishment-based S^D). But the press produces only food if it occurs when the light is on. So the light's being off suppresses responding, and the light's being on causes responding. As with our example of a stimulus-discrimination procedure based on reinforcement, we use one response (the lever press) and two stimuli (light on and light off).

Many instances of everyday life involve stimulus-discrimination procedures in addition to differential reinforcement and differential punishment procedures. We drive more carefully when our parents are riding with us. We talk more quietly in church. We practice harder when the coach is around. We speak more slowly when talking to someone learning English. We eat more politely in the presence of guests. All because of differential-reinforcement or differential-punishment procedures associated with particular S^Ds or S^Δs.

QUESTIONS

1. Compare and contrast the differential-reinforcement and stimulus-discrimination procedures.
   a. Be able to fill out each of the three balloons in each of the three drawings.
   b. Be able to do each of the three contingency diagrams.
   c. Understand and be able to fill out the table.
2. Give an example of the differential-reinforcement and stimulus-discrimination procedures involving a reinforcement contingency.
3. Now give an example of the differential-punishment and stimulus-discrimination procedures involving a punishment contingency.

Example

EDUCATIONAL PSYCHOLOGY

Multiple S^Ds and S^Δs: Poverty's Children—Part II[2]

Remember when some of Mae's friends asked her if they could use one of her classrooms as a preschool for 15 Black children who came from low-income families? These children scored an average of 21 points below the national average IQ score. Much of their problem was poor verbal skills. For example, they didn't use adjectives, like color, size, or number names. Mae's goal was to improve their use of descriptive adjectives. Her solution to problems was always the same: If a behavior doesn't occur often enough, we should reinforce it. So the teachers did the reinforcing, at Mae's request.

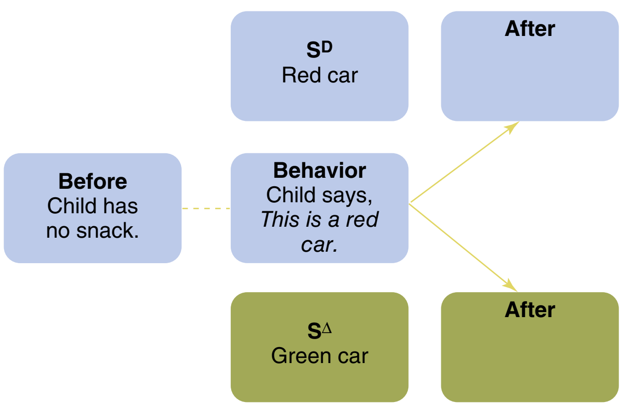
They began by providing reinforcement for all uses of color–noun combinations during the 3-hour session in the morning that included breakfast, structured time, and free play. Each time a teacher heard a child correctly use a color–noun combination, he or she smiled at the child and made an approving comment. The teachers used this procedure for 102 days, but the frequency of color–noun combos didn't increase! So they began to lose faith. They concluded that the children didn't have the words in their repertoire, or if they did, they couldn't use them correctly. But Mae didn't doubt for a second that reinforcement works; this was just the beginning of the battle.

Where'd they go wrong? Only one child used an average of one color–noun combination per hour; 10 of the children didn't use any. The teachers couldn't reinforce behavior that wasn't occurring.

So Mae asked the teachers to use another procedure—a discrimination-training procedure. She wanted to establish the various colors as S^Ds for the proper color-naming responses and as S^Δs for the wrong color-naming responses. For example, a red car should be an S^D for the response *red car*, and a green car would be an S^Δ for the response *red car*. A teacher would show various objects of various colors to the children and then point to one—for instance, the red car—and ask a child what it was. The teacher would then praise the child and give the child a small snack if he or she correctly named the object and the color by saying, for instance, *red car*. (If the child named the correct color without naming the object, the teachers praised her or him and then asked for the complete phrase before giving the snack.)

1. Please complete the following diagram.

Tact (Naming) Contingency



The results of the discrimination training were good, in terms of the stimulus control they established in the training sessions. At the end of 50 days of training, six different colors were exerting proper stimulus control over the naming responses of eight of the children, as were nine colors for the seven other children. These results hadn't come easily, but they were satisfying to both the teachers and the children.

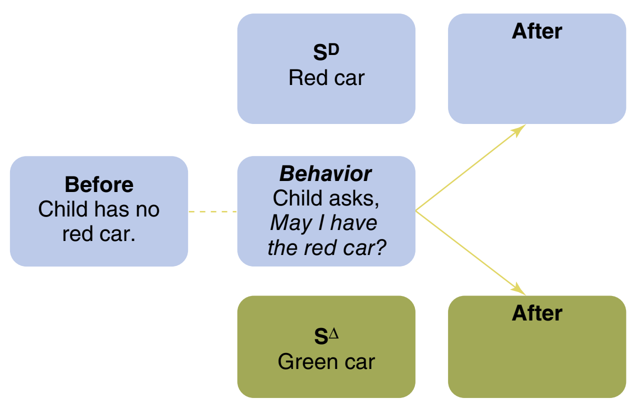
Now the proper stimulus control by these colors was in the children's object-naming repertoires. But that turned out not to be enough. Mae and her team were in for another disappointment, right after their triumph: Outside of the training session, in their normal day-to-day interactions, the children made almost no use of the color names they had learned. The group average of proper color-adjective use increased from 0.5 to 1.8 an hour; color–noun combinations increased from 0.2 to 0.4 per hour. Not much for 50 days of hard work!

Mae couldn't stop asking herself, *What's going to happen to these kids if they don't improve their language skills now? What am I going to tell the teachers who are discouraged with my interventions? What am I going to tell my father, who is so proud of the help I'm supposed to be giving the Black community? Some help!*

She decided to stop fretting and start solving. So she went into one of the classrooms, took a corner seat, and watched the children as they interacted with the teacher. She noticed the children in that group used color–noun combinations more often than usual. Why? The teacher always required the children to use proper color names to get the toys they wanted. For instance, a child asked the teacher for the pegboard materials by pointing at a piece. The teacher took that piece in her hand and waited until the child asked for it using the right color adjective. Then she gave it to the child.

2. Please complete the following diagram.

Mand (Requesting) Contingency



Of course, Mae said to herself, why didn't I think of this before? Why would the children use color–noun combinations if they can get their toys without going to that effort? But getting the toy would be a reinforcer and would reinforce their use of color adjectives in more natural settings. The teachers should do **incidental teaching**. They should differentially reinforce using color–noun combinations, and they should reinforce only correct color–noun combinations. In other words, they should combine differential reinforcement and discrimination training, so the colors of the objects would come to exert accurate stimulus control over the children's use of those color–noun combinations.

Definition: PROCEDURE

Incidental teaching

- The planned use of
- behavioral contingencies,
- differential reinforcement, and
- discrimination training
- in the student's everyday environment.

So Mae asked all the teachers in her preschool project to use incidental teaching. The teachers would give the children the toys they asked for, but only if they asked for the toys using color–noun combinations. The teachers did this incidental teaching for the next 19 days. They also used this incidental teaching with requests for snacks. Asking for a cookie or some fruit was no longer good enough. Now the children had to request the brown cookie, the yellow banana, or the red apple; the red car, the doll with blue eyes, the white bear, the orange airplane, or the pink Barbie dress. It worked! The average frequency of each child's using correct color–noun combinations increased from 0.4 to 14.2 an hour. Another way to put it is: When only praise followed the correct color–noun combinations, the children used adjectives only 22% of the times they requested something; but when the teacher gave them their requests contingent on correct color–noun combinations, they used correct color adjectives 75% of the times they requested things.

Mae had made her case. The teachers were convinced that they could help these children improve their verbal skills. It wasn't a question of inherited inferiority but of environmental contingencies. Where traditional methods of teaching language failed, behavior analysis once again made a difference.

Transfer of Training

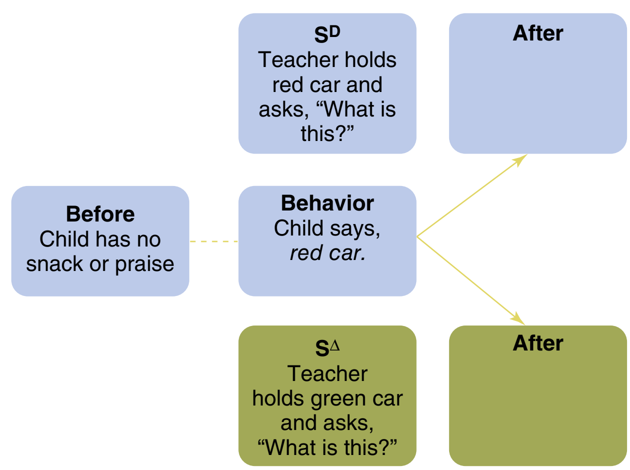
At this point in your study of behavior analysis, you're not surprised that reinforcement works. You're not surprised that the teachers could increase the frequency of little kids saying, *this is a red car*, rather than just *this is a car*, when the teacher holds up a red car and asks, *What's this*? But, like Mae and her teachers and most of the rest of the world, you might be surprised that this color-adjective training did ***not*** transfer outside the training setting to the rest of the classroom, the play area, and the snack area.

Why is everyone so surprised? We think it's because they think of the problem in this way: *The kids clearly did **know** the color of the car, so why didn't they use the color names in other settings?*

And those surprised people fail to follow the don't say rule; they say *know*. *The kids did **know** the color of the car*. What's the S^D for saying *red car?* To elaborate slightly on the previous diagrams, the S^D is the teacher's holding up a red car and asking, *What's this?*

And, what's the S^Δ for saying *red car?* And this time, to elaborate greatly on the previous diagrams, the S^Δ is much more than the teacher's holding up a green car and asking, *What's this?* It's everything in the kids' lives that doesn't involve the S^D. The S^Δ is all those occasions when the teacher doesn't hold up a red car and ask, *What's this?*

1. Please complete the following diagram.



So, what have we got when the red car is nearby, but the teacher doesn't ask, *What's this?* That's also an S^Δ for the kid saying *red car*. Why*?* Because *red car* has never been reinforced with a snack on such occasions.

So, we shouldn't be surprised that the children didn't request the red car in other settings. In fact, we should have been surprised if they had requested the red car. Why? First, *red car* had never been reinforced in any circumstance except when the teacher was holding the car and asking, *What's this?* So the other settings were S^Δs for saying *red car*.

Second, when the response *red car* had been reinforced in the training sessions, it had been reinforced with praise and snacks. So when the children's motivating operation was not having the red car (i.e., having the red car was the reinforcer), of course the children did not say *red car*, because in the past, *red car* had been reinforced with praise and snacks, not receipt of the red car itself.

Finally, we should have been shocked if the children had actually said, *May I have the red car?* because that response had never been reinforced in any circumstance. (We'll elaborate on transfer of training in Chapter 23.)

QUESTIONS

1. Diagram a procedure for teaching kids to use color adjectives when naming toys.
2. Diagram a procedure for teaching kids to use color adjectives when requesting toys.
3. And diagram their procedure for teaching kids to use color adjectives when naming toys, but diagram it to show why Mae and crew hadn't gotten transfer of training.
    a. What's *what is this* got to do with it?
4. ***Transfer of training***
    a. What are two reasons they failed to get transfer of training?
    b. What don't say rule did Mae and her crew violate, and why did that lead them to their false expectations?
5. ***Incidental teaching***
    a. Define it.
    b. Give an example of how incidental teaching resulted in transfer of training.

*Verbal Behavior (a.k.a.** Language) (B-14)

While we're drilling down into research on teaching kids to use adjectives, let's drill a little deeper, until we hit the verbal vein.

When the teachers held the red car and asked the students, "What is this?" the students would name (tact) the red car; the behavioral term for what most people would call *naming* things is *tacting*. When they correctly tacted the red car, they received a snack and praise from the teachers. Tacting is one form of language. Verbal behavior[3] is the behavior analysts term for *language*. In the case of the tact, the form of the response (for instance, *red car* vs. *green car*) is determined by an S^D (the teacher holding the red car and asking, *What is this?*). The reinforcer for tacting is usually approval from an observer. (Because, in this case, the teachers were teaching a new form of tacting to the children, they added a snack to the praise as the reinforcer for proper tacting.)

The behavior analyst's term for *requesting* is *manding*. Manding and tacting are two different forms of verbal behavior. The mand is usually reinforced by the receipt of the object or event requested rather than by praise. So people mand, when having the object or participating in the event would be a reinforcer. In other words, a motivating operation (no red car) usually causes the person to make the request (mand).

In training verbal skills to nonverbal clients, such as children with developmental disabilities and autism, behavior analysts explicitly train manding in addition to tacting, rather than doing what traditional teachers do, which is to teach tacting and naïvely assume that such teaching will automatically transfer to manding. Furthermore, behavior analysts often start with mand training, because it lends itself so readily to incidental teaching and can help to reduce problem behaviors. As a result of this emphasis on the mand, behavior analysts' clients acquire much more verbal behavior much more rapidly.

A **mand** is verbal behavior that specifies its own reinforcer. For example, the mand *please pass the hot sauce* specifies the reinforcer for that mand: namely, the hot sauce. **Mand**—*a verbal relation where the form of the response is determined by a motivating operation*. The form of the verbal response *please pass the hot sauce* is determined by the motivating operation, not having the hot sauce.

A **tact** is verbal behavior where the form of the response is controlled by an S^D, not by the reinforcer. For example, for the tact *That's a bottle of hot sauce*, the reinforcer might be the listener's approval, not the receipt of the hot sauce. The actual bottle of hot sauce is the S^D that causes the person to say *That's a bottle of hot sauce*. **Tact**—*a verbal relation where the form of the response is determined by a nonverbal* S^D.

Compare and Contrast

Mand vs. Tact	**Mand**	**Tact**
Also called	Requesting	Labeling
Caused by	Motivating operation	S^D
Reinforced by	Receipt of object requested	Praise

* *A.k.a.* stands for *also known as*, a term commonly found on FBI wanted posters. I'm sort of sticking it to my behavior analytic buds for using pompous jargon, when everyday English would do the trick (e.g., *verbal behavior*, *mand*, and *tact*). But we all of us behavior analysts use it, so you have to learn it.

By the way, be sure to avoid the common and reasonable mistake of thinking that when behavior analysts use the expression *verbal behavior*, they just mean *vocal behavior* or *vocal verbal behavior* (*talking*). No, for behavior analysts, *verbal behavior* also includes listening, reading, writing, sign language, and so on. *Verbal* means *language*, not *vocal*; of course, some dictionary definitions and everyday use tend to treat *verbal* as meaning *spoken*.[4]

QUESTIONS

1. Compare and contrast **mands** and **tacts**.
2. What does and doesn't *verbal behavior* mean?

PROMPTS (G-4)

Sid's Seminar

Tom: When we use reinforcement, the behavior has to occur before we can reinforce it. But the initial response rate was too low for reinforcement to work with most of Dr. Robinson's children. So I don't understand what was going on there.

Sid: Excellent point. What did the teachers do to get the children to use color–noun combinations in the first place?

Joe: The teachers gave the children verbal directions, like "Tell me, what color is the car?"

Sid: Right. That's a **verbal prompt**. At first, the teachers helped the children use color–noun combinations by prompting the response—by presenting a supplemental stimulus before the response. The teachers used various prompts adjusted to each child's needs. The most obvious prompt was to say the correct response just before the question: "The car is red. What color is the car?" The less obvious prompts were to name a color, give its initial sound, or ask the color of an object that another child had named correctly right before.

Joe: I see now that Butterfield and Staats also used prompts to teach Bobby to read. Remember? When Bobby failed to respond to a word, Butterfield told him the correct response and Bobby repeated it, looking at the word. Butterfield presented the S^D words over and over until Bobby was able to make the correct response to each of them without prompting.

Sid: Yes. There's no question that verbal directions can serve as prompts. Can anyone think of other ways to prompt behavior?

Sue: Yes! Remember in Chapter 11, the story of Madam Cupet, the ballet teacher? Besides giving verbal instructions to Bunny, she did two things. She **modeled** each exercise so Bunny could see how to do it correctly. She also physically guided Bunny's leg throughout each exercise. So, I guess that, besides prompting behavior before it occurs, we also can prompt behavior during performance, like when we guide a behavior physically.

Joe: She provided a **physical prompt**.

Sid: You're right. Tom gets a point for raising an important issue. Joe and Sue each get a point for discussing it. To summarize our seminar for today, remember we can ***prompt behavior with verbal instructions, modeling, and physical guidance***.*

Definition: CONCEPT

Prompt

- A supplemental stimulus
- that raises the probability of a correct response.

Sue: It helps me to think of a prompt as a supplement to the S^D or S^Δ.

Eve: Then how does a prompt differ from a regular S^D or S^Δ?

Sue: A prompt doesn't stand by itself. *The car is red* is a prompt that supplements the S^D *What color is the car?* But the prompt doesn't stand by itself. Suppose the teacher just says, "The car is red." That by itself would usually not be an S^D for the child's saying, "The car is red." But it will supplement the S^D *What color is the car?* And it will prompt the correct response.

JOE: I think of a prompt as a hint. It's often a hint as to the correct response, like the teacher might say *rrrr*. That would prompt red. This sort of prompt or hint is a partial response. And, as you say, it wouldn't function as an S^D by itself.

QUESTIONS

1. *Prompt*—define it and give an example.
2. Name and give an example of each of the three types of prompts.

* These are only some of the types of prompts. We might also use pictures, written words, positional prompts, etc.

Behavioral Special Education

JIMMY, THE CHILD WITH AUTISM—PART XIII

Preparing Jimmy to Be a Student

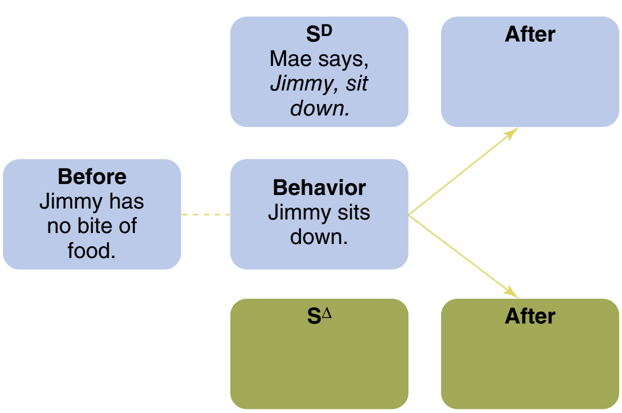
When Mae first started working with Jimmy, he was all over the place, and she found it impossible to teach him. Jimmy was not functioning like a proper student.

1. So the first thing Mae did was decide what a child would do to be considered a proper student; in other words, Mae performed

   a. differential reinforcement
   b. a shaping procedure
   c. a task analysis
   d. a motivating operation

Her analysis suggested that first the tasks of a good student were to sit down, look at the teacher, and not indulge in competing behavior such as self-stimulation. So Mae started with sitting down. She would give Jimmy a food reinforcer every time he sat down upon request.

2. Please complete the diagram for Jimmy's discrimination-training procedure:



3. At first, Jimmy never sat down in the presence of the S^D *Jimmy, sit down*. So Mae would take hold of him and sit him down. This is an example of what?

   a. an S^D
   b. a prompt
   c. a motivating operation
   d. a task analysis

As the training procedure progressed, Mae gradually faded out this physical prompt, reducing the pressure she used to sit him down until she merely had to place her hand lightly on his shoulder. Eventually, she could fade out the prompt completely.

QUESTIONS

1. Diagram Mae's procedure for bringing sitting down under stimulus control.
2. Describe the relevant physical prompt procedure.

HeroRATs

OK, so there's this hillbilly farm kid, little basketball-playing Al Poling, from West Virginia. Big Al gets his PhD at the University of Minnesota, joins the faculty at Western Michigan University, and ends up in Tanzania, Africa, playing with HeroRATs (2- to 4-pound giant African pouched rats). Big Al leaves the basketball team and joins an international humanitarian team working with the HeroRATs and searching for some of the millions of land mines that are killing 15 to 20 thousand people per year, worldwide, mainly civilians—adults and kids. For example, the civil war of Mozambique ended in 1992, leaving tens of thousands of live land mines planted throughout the country. The team of humanitarians with Al and the HeroRATs find and get rid of 69,269 land mines, returning 6,538 acres of useable land to the people of Mozambique, a country now declared free of land mines.

Though they are giant rats, the HeroRATs don't weigh enough to detonate land mines. So they were trained to scratch the earth where they smelled the TNT in the land mines, the S^D for earth scratching. A correct response would be reinforced with smashed banana mixed with rat chow. Actually the immediate reinforcer was the sound of the trainer's clicker, a conditioned reinforcer and the S^D for the HeroRAT to approach its trainer and get its delicious banana/lab chow mix.

But this is not as simple as you might think: You've trained up the HeroRATs at the training center in Tanzania. Cool. Now you go out into the real world: for example, the battle fields of Mozambique. How are you going to know what scratching responses to reinforce? Trust the HeroRATs? You've got to be kidding. If you reinforce scratching when you don't know for sure there's a scratching S^D, the smell of TNT, the HeroRATs will be doing so much S^Δ scratching they'll dig a hole to China. No problem. You just do discrimination training in the training camp, to make sure that, back on the battlefield, the TNT smell maintains its stimulus control over scratching and the HeroRATs continue to scratch only when they smell it.

Ah, but suppose these discriminating rats can discriminate between the training camp and the battlefield. What then? Because they're not getting any banana/chow reinforcers on the battlefield, their scratching will extinguish. So you've got to make sure each training camp is indiscriminable from the battlefield—the same lay of the land, the same slope, the same texture, the same ground cover. And that's what the humanitarian team did. No one said saving the world with behavior analysis would be easy.

P.S. They've since come up with an easier procedure where they plant some TNT sniffs in the actual battlefields, so that they can reinforce some of the correct S^D sniffs in their real world.

HeroRATs were also trained to sniff samples of human sputum (you now, the stuff you cough up when you're sick). TB-infected sputum was an S^D for a five-second pause, as the rats walked from sample to sample. Plain sputum was an S^Δ for the pause. It turns out that the HeroRATs are even 40% better at detecting the TB-sputum S^Ds than are humans with their microscopes. As of 2016, the HeroRATs had detected 9,127 cases of TB.

In 2016, the self-described hillbilly from West Virginia received the International Humanitarian Award for psychologists helping underserved populations.[5]

QUESTION

1. What are two discriminations HeroRATs were trained to make as humanitarian activities?

In the Skinner Box*

THE DISCRIMINATING PIGEON

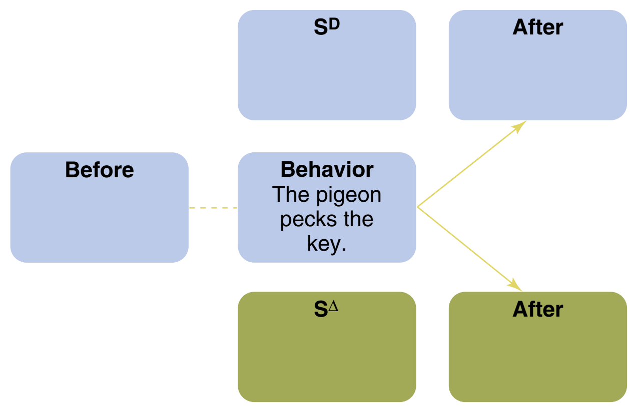
Now, back to our good, old Skinner box. How would you show stimulus discrimination? Skinner showed it with a pigeon pecking a single response key. Sometimes the key was lighted, and sometimes it was dark (when it was lit, it was lit from behind, so that the light showed through the key—transilluminated). The pigeon got food when it pecked the key in the presence of the lighted key, the S^D, but it didn't get food when it pecked the key in the presence of the dark key, the S^Δ. Stimulus control was so great that the bird's head moved back and forth as if it were on the end of a rubber band; when the key light was off in the middle of a key peck, the bird jerked its head back just before hitting the key. If the bird was still in the process of withdrawing its head when the light came on again, the bird immediately returned to work.

Incidentally, much of the basic research on stimulus control with animals involves situations like this: The experimenter presents the S^D for a period of time and then presents the S^Δ for a period of time, and he or she records the frequency of responding in the presence of each stimulus.

QUESTIONS

Please complete this diagram describing the preceding pigeon demonstration:

Discriminated Reinforcement



1. Diagram a procedure that would show stimulus discrimination with pigeons.

REQUIREMENTS FOR EFFECTIVE DISCRIMINATION TRAINING

Pre-Attending Skills

Remember how Butterfield and Staats taught Bobby to read? They began by making sure Bobby looked at the words (S^Ds); orienting himself toward it was a prerequisite for the written word to control Bobby's response. If you don't believe us, try reading this without looking at the page. (You fail the quiz!) Orienting toward the S^D is what some behavior analysts call pre-attending skills.

Sensory Capability

Of course, to learn pre-attending skills you need sensory capabilities. You need vision, hearing, touch, taste, and smell for the relevant stimuli to control your behavior. For instance, oral requests won't control your behavior if you're not able

* Based on *Learning and Behavior* (a motion picture). Columbia Broadcasting System, "Conquest" series.

to hear. (Though, sometimes, your little brother's calls don't control your behavior although you are able to hear, and you indeed have heard it. Any ideas why?)

Conspicuous Stimulus

But even if you have the sensory capabilities and pre-attending skills, some stimuli don't control your behavior. Why do only some stimuli from the environment control your behavior and others don't? The effectiveness of stimulus control depends in part on how the stimulus is presented. Some stimuli are more conspicuous than others. A conspicuous stimulus is one that contrasts with its background because of its large size, its brightness, its loudness, its uniqueness, or the like. Have you ever gotten a traffic ticket for not having money in the meter? If you look carefully, you might find tiny letters perpendicular to the major text saying that if you hurry on and get to the nearest violations bureau in less than an hour from the time of the ticket, you'll pay only half the penalty. Most often those tiny letters don't control reading behavior. On the contrary, have you ever seen one of those WARNING—MAD DOG signs? When those signs are well displayed, probably you'll see the dog before the dog sees you. The more conspicuous the stimulus is, the higher the probability that that stimulus will control behavior.

Discrimination-Training Procedure

Another requirement for stimulus control is a history of behavioral contingencies in the presence of that stimulus. For instance, let's think of a stimulus paired with a reinforcement contingency. Only if a behavior has repeatedly produced a reinforcer in the presence of that stimulus will that behavior occur more frequently in the presence of that stimulus in the future. Why do you always tell dirty jokes to your roommate? Because she loves it; when you do so, she laughs like crazy. Naughty roommate. Naughty you.

QUESTION

1. List four prerequisites for effective discrimination training and give an example of each.

Compare and Contrast

DISCRIMINATIVE STIMULUS (S^D) VS. BEFORE CONDITION

Students and professionals alike often confuse **before conditions** with **S^Ds**. So, let's try to clear it up. Suppose a child's mother has normal hearing, but the father has impaired hearing. Then the sight of the mother probably acts as an S^D, a stimulus in the presence of which asking for food is reinforced. The sight of the father acts as an S^Δ for food asking.

Now further suppose the child hasn't eaten for a couple hours. Then, of course, the child will request food more frequently when he has no food than when he does. And the request for food will still occur more frequently in the sight of the mother than in the sight of the father. The before condition and the S^D share some common characteristics. Both occur before the behavior.* And both increase the frequency of the behavior.

However, you should distinguish the before condition from the S^D. A before condition is needed before an after condition can be reinforcing, but it doesn't guarantee the presentation of that reinforcer. However, an S^D does guarantee that a reinforcer will more likely follow the response. For instance, that the child has no food (before condition) doesn't mean he'll get food when he requests it; the request won't produce food, if no one's there. However, in Mom's presence the child's request will produce food, though Mom's presence doesn't guarantee the child will give a damn (it doesn't guarantee there's no food in the before condition or that he had been food deprived earlier).

For reinforcement to occur, you often need both the before condition and the S^D. If the before condition is absent, a

* Dear Instructor: Here are three expressions we've dropped: We've stopped using the expression *antecedent stimuli*, *antecedent condition*, or simply *antecedent* as the generic term to encompass the *motivating operation*, the *before condition*, and the *SD* because we think it causes professionals, as well as students, to confuse those three concepts with each other. We have stopped using *evoke*, *evocation*, and *evocative*, because we think students have too much trouble understanding the words. Instead, we simply word the sentences differently, or use some variant of *cause*, at the risk of offending those who think *cause* means *ultimate* or *sole cause*. And, as mentioned earlier, we've stopped using *response likelihood*, as well as *response probability*, because Jack Michael said we should stop. We've long objected to the almost metaphorical or hypothetical-construct use of *response probability* (what's the probability of a response that occurs 100 times per minute?). And Jack convinced us that *response likelihood* ain't much better. We've found that *response frequency* is a perfect and easy replacement, applying to both relative and absolute frequency; in other words, it also applies to those discrete trial occasions where *response probability* is an appropriate term, as well as to those free-operant occasions where *response probability* is metaphorical. However, in all three cases, these textbook changes are compatible with your continuing to use the more traditional terminology if you prefer; they don't contradict and can comfortably coexist.

particular event doesn't act as a reinforcer. If stimulus control has been established and the S^D is absent, the behavior that produces the reinforcer might not occur, so it can't be reinforced.

Discriminative Stimulus (S^D) vs. Before Condition

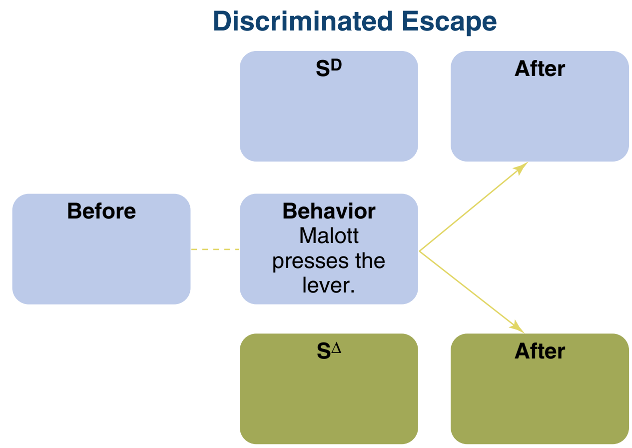
	Before	S^D
Occurs	Before behavior	Before behavior
Effect	Increases behavior	Increases behavior
Will make the after condition reinforcing	Yes	No
Is associated with increased likelihood of reinforcers	No	Yes

In the case of the escape contingency, most people fail to discriminate between the before condition (motivating condition) and the S^D. Here's your chance to show you're not one of the confused: Please explain the discrimination in this case.

1. This time, Rudolph the Rat has Dr. Richard W. Malott in the Skinner box. When the shock is on, Malott can press the lever and escape the shock. What is the shock?
   a. before condition
   b. S^D

(Most people make the mistake of saying the shock is the S^D. It might be easier to see why the shock is not the S^D if we look at a good example of an S^D: The shock comes on, but his lever presses will turn it off only when the light comes on. When the lights are off, he can pound his little fists raw, and the lever still won't turn off the shock. Poor Dr. Malott.)

2. What's the light?
   a. before condition
   b. S^D
3. What's the shock?
   a. before condition
   b. S^D
4. Please diagram poor Dr. Malott's plight.



QUESTIONS

1. Fill out the table that compares and contrasts the before condition and the reinforcement-based S^D.
2. Diagram an example of discriminated escape.

Compare and Contrast

DISCRIMINATIVE STIMULUS (S^D) VS. OPERANDUM

Students and even professionals often confuse the **operandum** with the S^D. So let's work on that distinction.

Definition: CONCEPT REVIEW

Discriminative stimulus (S^D)

- A stimulus in the presence of which
- a particular response will be reinforced or punished.

Definition: CONCEPT

Operandum (manipulandum)

- That part of the environment
- the organism operates (manipulates).

Tricky plurals: *Stimulus* is singular. *Stimuli* is plural, not *stimuluses*. *Operandum* is singular. *Operanda* is plural. *Manipulandum* is singular. *Manipulanda* is plural. These are Latin words. They're what the smart folks use. But we'll use them, too; and if we don't screw up the singulars and plurals, no one will ever know whether or not we're also smart folks.

In the Skinner Box

1. When the light is on, Rudolph presses the lever and receives a drop of water. When the light is off, Rudolph will receive no water, even if he presses the lever. Is the light something Rudolph operates or manipulates?

a. yes
b. no

(Hint: The light's in the ceiling; Rudolph can't even touch it.)

2. Will Rudolph's response be reinforced when the light is on?

a. yes
b. no

3. So what's the light?

a. S^D
b. operandum

What's the lever? Well, it's something Rudolph operates. Lever pressing can't occur without it. So lever pressing can't be reinforced without it. Can the lever be both an S^D and an operandum for the same response? That's where the confusion enters. So check this.

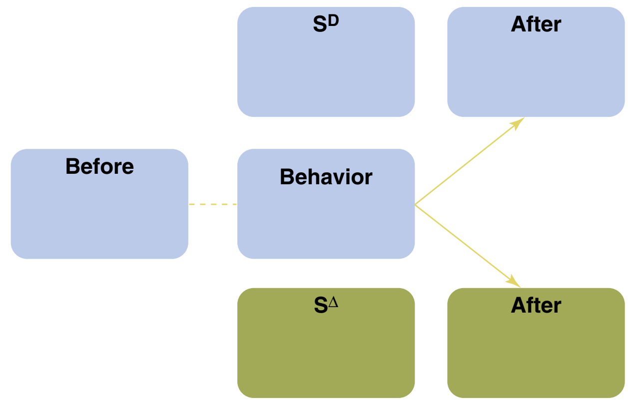
The S^D is associated with the opportunity for reinforcement.

The operandum provides the opportunity to respond.

We're distinguishing between the opportunity to respond and the opportunity for reinforcement, given that you have the opportunity to respond. The S^D is associated with the opportunity for reinforcement when a response is possible. If the lever is in the box, then Rudolph can press it; the lever provides him the opportunity to respond.

But that's not the same as the opportunity for reinforcement. When the light is off, lever pressing won't produce water, even though the lever's in the box and Rudolph is pressing like mad. But when the light comes on, Rudolph now has the opportunity for reinforcement; he presses the lever and gets a drop of water. The light is the S^D. The lever is the operandum. The lever cannot be both operandum and S^D for the same response.

1. Please diagram Rudolph's contingencies in the previous example. In the behavior component, mention the operandum. But first, review this definition: ***S^Δ****—a stimulus in the presence of which a particular response will not be reinforced or punished.*



Just as the lever is not an S^D for lever pressing, so too the Skinner box itself is not an S^D for lever pressing. The lever and the box are just part of the environment associated with the opportunity to respond.

Here's another way to distinguish between the S^D and the operandum:

2. What's an S^D?

a. an opportunity for the response to be reinforced
b. an opportunity for the response to be made

3. What's the response lever?

a. an opportunity for the response to be reinforced
b. an opportunity for the response to be made

4. What's being in the Skinner box?

a. an opportunity for the response to be reinforced
b. an opportunity for the response to be made

So, you want to avoid confusing the opportunity for reinforcement (the S^D) with the opportunity to make the response (the operandum or the environment containing the operandum).

5. And what's the keyboard on your piano?
6. Playing a chord on your piano?
7. The strings on your guitar?
8. The feeling in your fingers when you strum your guitar?

Our answers: 5. the operandum, 6. the response, 7. the operandum, and 8. just a stimulus.

Compare and Contrast

DISCRIMINATIVE STIMULUS (S^D) VS. NONDISCRIMINATED REINFORCEMENT CONTINGENCY

Sometimes you will have trouble finding the S^D. Then look for the S^Δ. If you don't have an S^Δ, then you don't have an S^D. Ask if the response can be reinforced any time it has an opportunity to occur. If the answer is *yes*, that also means you have no S^D. Instead, you have a *nondiscriminated reinforcement contingency—there is no S^D associated with the reinforcement contingency*. In other words, maybe the reinforcement contingency isn't always in operation, but when it is, there is no special stimulus (S^D) present. However, in most examples of the nondiscriminated reinforcement contingency, the reinforcement contingency actually is in operation at all times, 24/7. In other words, there is no S^Δ condition; instead, if the operandum is present, the response can be reinforced.

On the other hand, if you do have an S^Δ, then you must also have an S^D, and then you have a *discriminated reinforcement contingency—the reinforcement contingency is in operation only when the S^D is present, not when the S^Δ is present*. If a response is never being reinforced, then we'd just call that plain old *extinction*. Of course, we can also have discriminated and nondiscriminated escape and punishment.

The Skinner Box: Nondiscriminated Reinforcement Contingencies

You put experimentally naïve son of Rudolph in a modified Skinner box for the first time. There's no special light in the box, just the ambient light of your lab. But the major modification of the box is that you can remove and insert the response lever at will. You shape up lever pressing and then begin removing and re-inserting the lever.

1. Does this experiment involve an S^D?

a. yes
b. no

Remember: An S^D is a stimulus in the presence of which a particular response will be reinforced or punished. Sounds like the response lever might be the S^D. But the lever is the operandum, and the operandum can't be its own S^D. You might think inserting the lever into the Skinner box makes it the S^D and its absence would be the S^Δ. But, think about it: Will the lever press be reinforced anytime it has an opportunity to occur? Yes. An S^D deals with opportunity for reinforcement, not the opportunity for the responding. The presence of the operandum more or less guarantees the opportunity to respond, but the presence of the S^D more or less guarantees the opportunity for that response to be reinforced (note that with some procedures, even in the presence of the S^D, the response might only occasionally be reinforced, but we won't worry about that until Chapter 20.)

2. So which does this lever-in/out Skinner box experiment involve?

a. an S^D
b. a nondiscriminated reinforcement contingency

Just to get yourself centered on more familiar turf, you stick a light in the Skinner box and turn it on when you will reinforce lever pressing and turn it off when you won't.

3. Now what does this experiment involve?

a. an S^D
b. a nondiscriminated reinforcement contingency

Remember: *If you think the S^D is the operandum, it ain't; and you may not have an S^D*. But not to worry; much and maybe most of life consists of nondiscriminated positive and negative reinforcement and punishment contingencies. When you itch, you scratch and get some relief from that aversive condition; and the scratch always works, more or less, not just when the green light is on.

Applied Behavior Analysis: Nondiscriminated Punishment Contingencies

Remember Velma and Gerri's problem with teeth grinding (Chapter 2)? The use of the ice cube on the cheek following teeth grinding was a nondiscriminated punishment contingency. Although the contingency wasn't always operating, there was no functional S^D associated with the occasions when the experimenters were present, because both Velma and Gerri were deaf and blind.

Summary

By way of summary, you'd do well to master the following criteria:

Definition: CRITERIA FOR DIAGRAMMING DISCRIMINATED CONTINGENCIES

S^{Δ} test

- Is there also an S^{Δ}? (If not, then you also don't have an S^{D}.)

Same before condition test

- Is the before condition the same for both the S^{D} and the S^{Δ}?

Response test

- Is the response the same for both the S^{D} and the S^{Δ}?

Extinction/recovery test

- Is the S^{Δ} contingency always extinction or recovery?

Operandum test

- Does the S^{D} differ from the operandum?

Different before condition test

- Does the S^{D} differ from the before condition?

QUESTION

1. Know the criteria for diagramming discriminated contingencies, and be able to recognize when there is and is not an S^{D}.

Notes

1 Based on Staats, A. W., & Butterfield, W. H. (1965). Treatment of non-reading in a culturally deprived juvenile delinquent: An application of reinforcement principles. *Child Development*, *36*, 925–942.
2 Based on Hart, B. M., & Risley, T. R. (1968). Establishing use of descriptive adjectives in the spontaneous speech of disadvantaged preschool children. *Journal of Applied Behavior Analysis*, *1*, 109–120.
3 Skinner, B. F. (1992). *Verbal behavior*. Acton, MA: Copley Publishing Group.
4 For a more sophisticated treatment of verbal behavior, see Catania, A. C. (1998). *Learning*. Upper Saddle River, NJ: Prentice Hall.
5 Poling, A. (2016). Using pouched rats to help people: Notes from the field. *American Psychologist*, 835–842. Retrieved from www.youtube.com/watch?v=XWftooMno0U

CHAPTER 15

Complex Stimulus Control

Behavior Analyst Certification Board 5th Edition Task List Items		
B-2.	Define and provide examples of stimulus and stimulus class.	Throughout
B-10.	Define and provide examples of stimulus control.	Throughout
B-11.	Define and provide examples of discrimination, generalization, and maintenance.	Page 281
C-8.	Evaluate the validity and reliability of measurement procedures.	Pages 295–296
G-4.	Use stimulus and response prompts and fading (e.g., errorless, most-to-least, least-to-most, prompt delay, stimulus fading).	Pages 286–287, 290–291
G-7.	Use shaping.	Page 287
G-10.	Teach simple and conditional discriminations.	Page 288

How can we respond correctly in a novel situation, a situation we've never been in before, a situation where, previously, the correct response has never even had a chance to occur, let alone to be reinforced? That sort of complex, novel stimulus control is what this chapter is about. And much of the criticism of behavior analysis is based on the false assumption that behavior analysis cannot explain that sort of complex, novel stimulus control. Too bad the critics haven't read this chapter or the research that inspired it.

The Experimental Analysis of Concept Training

THE PECKING PIGEON PEOPLE PEEPER[1]

What is a person? Plato defined a person as a two-legged animal without feathers. Sly Diogenes then plucked the feathers from a chicken and brought it into the academy. Academicians then realized they would have to change their definition. They thought awhile and finally claimed, "A person is a two-legged animal without feathers but with broad, flat nails."

In only a few moments you can think of exceptions to this rule. You can think of a creature that fits the rule but is not a person. You also can think of a creature that doesn't fit the rule but is a person. A chimpanzee fits the rule but isn't a person. A human being without arms or legs doesn't fit the rule but is a person.

It may well be an impossible task to give a set of rules that describes and defines the concept *person*. Interestingly enough, we correctly use the concept of *person*, though we can't give a good explicit definition. It seems that almost intuitively we know what a person is. This shows what we mean when we say we are doing something according to ***intuition***. When we say we're behaving intuitively, all we mean is that we're behaving without thinking about it. We're not Googling the definition of *person* to decide if that thing we're looking at is a person. We just sort of know, intuitively, without asking. When we behave intuitively, our behavior is being controlled by a concept we can't define or at least haven't bothered to define.

Note that the person may or may not be able to define the concept, but at the time of interest, a statement of that definition is not controlling the person's behavior. For example, "I may not be an artist, but I know what good art is." Even an artist probably would have a hard time giving a set of rules that allows you to select good art from bad art, yet what the artist selects might be under reliable control of stimulus characteristics of good artwork. Intuitive concepts of good and bad art are exerting stimulus control over the behavior of the artist.

An intellectual woman once asked the jazz musician Fats Waller, "How do you define jazz?" Fats replied, "Honey, if you don't know what jazz is, I can't tell you." In other words, jazz was exerting intuitive stimulus control over Fats's behavior. When he lit a cigar and sat down at the piano to play, Viennese waltzes didn't roll forth from his fingertips.

And what about you? You may be able to tell the difference between classic rock, heavy metal, punk, new wave, and grunge, but can you define them? Are these concepts exerting intuitive control over your behavior?

How do such intuitive concepts come to have stimulus control over our behavior if no one knows the rules defining the concepts? Consider the concept of *person*. Intuitive stimulus control might evolve something like this: A young girl correctly points to a person or a picture of a person. The child says, "Person," and her parents' approval reinforces this behavior. When the child points to a picture of a chimpanzee and says, "Person," the parents tell the child, "No." This might mildly punish the incorrect response. After many such trials, an intuitive concept of *person* may come to exert stimulus control over the child's behavior.

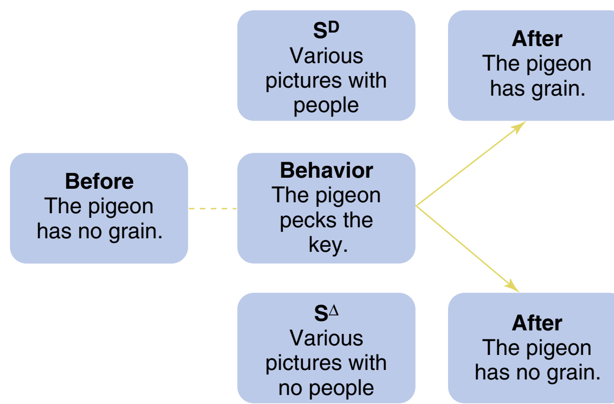
Drs. Herrnstein and Loveland studied this process of intuitive concept learning in a fascinating experiment at Harvard University. These scientists showed that even the behavior of pigeons could come under the control of the concept of *person*—to be more exact, under the control of the concept of *picture of person*. Of course, at the same time, their behavior also came under the control of the concept of *nonperson*.

Training

Herrnstein and Loveland used a straightforward concept-training procedure. They projected a variety of pictures (one at a time) on a viewing screen in the pigeon's Skinner box. The experimenters reinforced pecking the response key when the pictures contained people. But they withheld reinforcement when the pictures didn't contain people. So pictures with people served as the S^D (discriminative stimulus) for the key peck, and pictures without people served as the S^Δ.

The photographs came from various settings, such as countrysides, cities, expanses of water, lawns, and meadows. And some of the pictures were of single people, several people, people partly covered by objects, fully clothed, partially clothed, unclothed, both sexes, all ages, all races, in all sorts of positions. As you can see, Herrnstein and Loveland used a tremendous variety of stimuli. The S^Ds contained many different pictures of persons, and the S^Δs contained many different pictures of nonpersons.

Concept Training



The concept of *person* is complex, and to our knowledge, this was the first attempt to teach such a complex concept to a nonverbal animal. But the birds' behavior came under proper stimulus control rapidly. In fact, sometimes when the birds appeared to make mistakes, the experimenters looked more closely and would find a person hidden in some corner of the picture. The pigeons were about as good as the experimenters at responding to the presence of human beings in the pictures.

Testing

We have seen that the key peck of the pigeon in the Skinner box was under the control of the concepts of *person* and *nonperson*. This concept didn't hold just for the specific stimuli in training. After much concept training, they tested for stimulus generalization to novel pictures to the birds.

Results

When the experimenters showed a novel picture of a person or a nonperson, the birds responded correctly to it. This is a most important aspect of conceptual control (i.e., responding correctly to concepts). It results in responding correctly in novel situations.

Discussion

So the point of this classic experiment is that conceptual stimuli such as the pictures of people can exert stimulus control over the behavior of a pigeon, just as conceptual stimuli such as heavy metal can exert stimulus control over your behavior, causing you to properly label certain music as *heavy metal*.

1. In spite of the title of this section and the example being analyzed, many students still seem to think that only human beings can be under conceptual stimulus control. What do you think?
   a. Conceptual control works only for human beings.
   b. It works with other animals as well.
2. Please justify your answer.

Notice that we don't say that people and pigeons *have concepts*. Instead, we say that their *behavior is under the stimulus control of concepts*. A little longer, but it may help us focus on what concepts are really about; they're a set of stimuli, and they either exert stimulus control or they don't.

QUESTION

Danger: Study this section extra carefully, because students often mess up their answers to this one on the quiz.

1. Concerning the experiment to teach the concepts of *picture of person* and *picture of nonperson* to pigeons:
   a. Diagram the training contingencies.
   b. What was the testing procedure?
   c. What were the results?

Concepts

STIMULUS CLASS, STIMULUS GENERALIZATION, AND CONCEPT TRAINING (B-2) (B-11)

Herrnstein and Loveland used a **concept-training procedure*** to establish conceptual control over the pigeons' key peck response by the concept of *person* (in plain English, to teach the concept of *person*). Such a procedure is more complex than the simpler discrimination-training procedure. The simpler procedure uses only a single S^D and a single S^Δ (e.g., a green light vs. a red light). However, instead of two individual stimuli, Herrnstein and Loveland used two stimulus classes (people vs. non-people). So let's take a brief look at stimulus class.

* This is also commonly referred to as ***multiple-exemplar training***.

Definition: CONCEPT

Concept training

- Reinforcing or punishing a response
- in the presence of one stimulus class
- and extinguishing it
- or allowing it to recover
- in the presence of another stimulus class.

The notion of **stimulus class** parallels that of response class. A stimulus class consists of a set of stimuli that all have some common property. In the Herrnstein–Loveland experiment, one set of stimuli, pictures of persons, had the common property of containing at least one person. This stimulus class also had another common behavioral property: All pictures of persons served as S^Ds for pecking the key. Nonhuman pictures served as S^Δs for pecking. Another name for stimulus class is ***concept***.

Definition: CONCEPT

Stimulus class (concept)

- A set of stimuli,
- all of which have some common physical property.

We know that conceptual stimulus control (or just conceptual control) is occurring when two conditions are met:

1. The observer responds in a similar way to all stimuli in a stimulus class (including novel stimuli not previously experienced).
2. The observer does not respond that way to novel stimuli outside that class.

When the observer responds in a similar way to different stimuli, we say **stimulus generalization** is occurring. Herrnstein and Loveland reinforced key pecks in the presence of specific human pictures. Then the effects of the reinforcement generalized to novel pictures of other persons. So **conceptual stimulus control** consists of generalization within a concept or stimulus class and discrimination between concepts or stimulus classes. To establish conceptual stimulus control, we must reinforce one response in the presence of one stimulus class or concept and extinguish that response in the presence of all other stimulus classes or concepts.

Definition: CONCEPT

Stimulus generalization

- The behavioral contingencies
- in the presence of one stimulus
- affect the frequency of the response
- in the presence of another stimulus.

Conceptual stimulus control (conceptual control)

- Responding occurs more often in the presence of one stimulus class
- and less often in the presence of another stimulus class
- because of concept training.

Often, critics of behavior analysis argue that our approach is too limited. But such critics don't understand how concept training can explain the occurrence of appropriate responses in novel situations, situations the person or animal has never experienced before. And, as you can see, the notion of conceptual stimulus control allows us to understand and even predict the occurrence of appropriate responding in novel situations.*

Notice that the definition of concept training is identical to that of stimulus discrimination training, except for one word: Concept training deals with stimulus classes, whereas discrimination training deals with individual stimuli. But what a difference a single word can make. It's the difference between being able to recognize your best friend from many different angles and distances and in many different clothes (the stimulus class of your friend) vs. being able to recognize your friend from only one specific view, for example (individual stimulus).

Imagine that our behavior was so limited we could respond correctly only in situations where we had received specific training. This would severely impair our ability to function because, day to day, even moment to moment, we find ourselves in situations slightly different from any we have experienced before. But those situations also are slightly similar. And they generally fall within some concept. It might be the concept of dining room, food, classroom, teacher, or classmate. Our training in the presence of earlier examples of the concept generalizes to the new instance, and we respond accordingly. As we have seen, this valuable ability to generalize within stimulus classes is available both to humans and nonhumans, such as pigeons. The pigeons respond accurately when we show them novel pictures.

So, a pigeon's behavior can be under the control of complex concepts, such as person and nonperson. We don't know the exact limitations of the pigeon's concept of person. For example, what would happen if we showed a pigeon a picture of a scarecrow or a chimpanzee? Would the bird classify it as person or nonperson? It may well be that if the pigeon didn't have specific training using such examples, its behavior might not be under perfect control of the concept. But that's true of human behavior, too: Without specific discrimination training, we might overgeneralize from person to chimpanzee and scarecrow, just as the young child overgeneralizes from his or her father to all men.

Clarification: By ***novel*** all we mean is *new*. And a *novel stimulus* is just a stimulus that is different from other stimuli we've experienced. But, in this context, a *novel stimulus* must have properties or characteristics similar to other stimuli we're familiar with. A picture of your iPhone would definitely have been a *novel* stimulus for Herrnstein and Loveland's 1964 pigeons, but it wouldn't have had any relevant properties or characteristics in common with pictures of 1964 people. So it wouldn't be in the people stimulus class. Not all novel stimuli share similar properties or characteristics. And those novel stimuli without at least some similar properties or characteristics won't be in the same stimulus class, so training with stimuli in that stimulus class will not result in responding to those novel stimuli.

QUESTIONS

1. *Concept training*—define it and give an example.
2. *Stimulus (concept)*—define it and give an example.
3. *Stimulus generalization*—define it and give an example.
4. Conceptual stimulus control (conceptual control)—define it and give an example.

The Experimental Analysis of Concept Training

ART APPRECIATION 101 FOR PIGEONS[2]

Here's a newer and even more exciting extension of the classic Herrnstein and Loveland experiment. This experiment was

* Concept training is sometimes done intentionally by researchers, teachers, or parents, but nature can also be responsible for concept training.

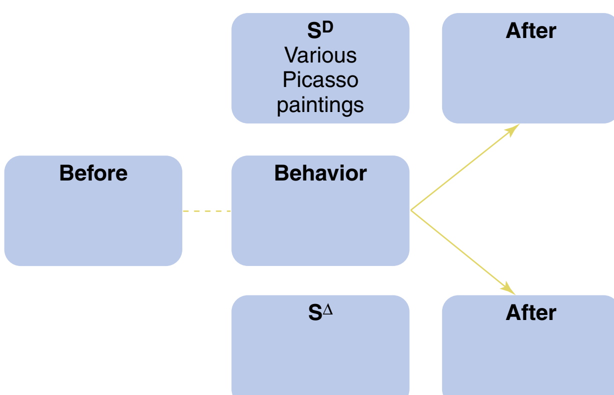
conducted by Dr. Shigeru Watanabe, Wakita, and Sakamoto (1995)[3] at Keio University, the behavior analysis center of Japan.

Training

The first group of pigeons was shown slides of paintings by the impressionist Monet and by the cubist Picasso (the slides were projected from behind onto the pigeon's response key). When the Monet paintings were projected, key pecks were reinforced with food. And when the Picasso paintings were projected, key pecks were extinguished. The reverse was done for the second group—when the Picasso paintings were projected, key pecks were reinforced; and when the Monet paintings were projected, key pecks were extinguished. After 20 or so sessions, the discriminations were clear. Pigeons reliably pecked at the Monets in the first group and the Picassos in the second, rarely making mistakes.

Please diagram the training contingencies for the Picasso group:

Concept Training



Testing and Results

Shigeru and his fellow art lovers then did generalization tests with novel paintings by Monet and Picasso. The Monet-pecking pigeons readily pecked at the new Monets but not at the new Picassos, while the Picasso-pecking birds reliably did the opposite.

Then the researchers went even further and presented the birds with impressionist paintings by Renoir and cubist paintings by Braque. The impressionist Monet-trained birds pecked the impressionist Renoirs, not the cubist Braques. The Picasso-trained birds, on the other hand, pecked the Braques but not the impressionistic Renoirs. At this point, apparently, the Monet pigeons were clearly aficionados of the impressionistic school of art, while the Picasso birds had become aficionados of cubism!

Going even further out on a limb, where few pigeons would dare to roost, the scientists removed color and projected only black-and-white renditions of the artwork. Excellent stimulus control was maintained.

Then they projected the paintings out of focus to reduce the sharp edges and make the paintings equally blurry. But excellent stimulus control still maintained.

I don't know how it is in Japan, but those pigeons would pass any U.S. art appreciation course with flying colors. Now, if someone will do the same experiment with jazz vs. polka, Fats Waller will be able to rest in his grave.

QUESTIONS

1. Concerning the experiment to teach the concept of *Picasso paintings* to pigeons:
   a. Diagram the training contingencies.
   b. What was the training procedure?
2. What were the results?

Examples and Non-Examples

CONCEPTUAL CONTROL AND OTHER CONCEPTS

Let's take a brief glance at a few examples of these and other relevant and potentially confusing concepts. This way, we can make sure they're exerting proper conceptual control over your behavior. First, look at the possible concepts. Then look at each example and select the possible concept or concepts that the example best illustrates. Use a card or piece of paper or your hand to cover up our answers as you read. That will help you give it your best shot.

The Concepts

1. S^D
2. S^Δ
3. Punishment-based discriminative stimulus
4. "Simple" discrimination-training procedure
5. Stimulus discrimination (stimulus control)
6. Stimulus class (concept)
7. Stimulus generalization
8. Conceptual stimulus control
9. Conceptual training

The Examples

Question

A set of pictures of people. Did you select your answer? Yes. Good, it's a pleasure to work with a non-cheater. Now look at our answer.

Our Answer

Of course, this was our original example of a stimulus class. And any stimulus class also is a concept. We just put this one in to see if you're alive.

Question

Sid puts a red apple and a yellow banana in front of Rod. Sometimes he asks Rod to point to the red apple and sometimes to point to the yellow banana. What are the red apple and the yellow banana?

Our Answer

Tricky. The apple is both an S^D and an S^Δ. It's an S^D for pointing to it when Sid says, "Point to the red apple." It's an S^Δ for pointing to it when Sid says, "Point to the yellow banana." We'll let you work out the details regarding the yellow banana.

Also one red apple, a *single stimulus* by itself, doesn't make a stimulus class; remember, you need a bunch of different red apples, a *set of stimuli*, to have a stimulus class.

Question

The sweet taste of the red apples reinforces Rod's eating them. The tart taste of the green apples does not. Over a period of a few weeks, Rod eventually stopped eating the green apples but continued eating the red ones. What are the red apples?

Our Answer

A stimulus class or concept (the same thing). You might have said an S^D, and that's right, but not specific enough. The reason is that we're talking about a large number of different red apples. So they are part of the stimulus class we call "red apples." (By the way, this is an example of concept training where mama nature is the trainer, as mentioned in a footnote earlier.)

Question

What kind of control are those red and green apples exerting over Rod's eating?

Our Answer

Conceptual stimulus control. Again, saying "stimulus control" is not specific enough.

Question

Is this also an example of stimulus generalization? Why or why not?

Our Answer

Yes, it is stimulus generalization—stimulus generalization among the various examples of the concept of red apple and stimulus generalization among the various examples of the concept of green apple.

Question

What kind of training procedure caused Rod to become a discriminating apple eater?

Our Answer

Conceptual training, because the eating response is reinforced in the presence of a number of different specific red apples, and it is extinguished (maybe even punished) in the presence of a number of different green apples.

Question

Whenever Rod sees his Uncle Ben, he looks at the man, smiles, and says, "Candy, please." This always gets the uncle, and Ben always reaches into his pocket, pulls out a Life Savers, and gives it to the young panhandler. However, Uncle John, the dentist, is unwilling to sacrifice the child's dental health just to gain immediate approval. So, eventually, Rod only hits on Ben. Technically, what is Ben and what is John?

Our Answer

Ben is an S^D for requesting candy. John is an S^Δ. We have only one Ben and one John, so we don't have stimulus classes (at least not from a simple point of view).

Question (for Advanced Students Only)

Suppose, by the end of this chapter, you can discriminate between novel examples of simple stimulus control and conceptual stimulus control. What would your behavior be an example of?

Our Answer

Conceptual stimulus control. Our using "novel examples" in this example makes conceptual stim control.

Question (for Advanced Students Only)

Now suppose instead we gave you only one example of simple stimulus control and one of conceptual stimulus control. And in this case, you could not discriminate between novel examples of simple stimulus control and conceptual stimulus control. However, you were a killer when it came to the two examples we had given you. What would this be an example of?

Our Answer

Just plain stimulus control, because there's only one example in each set of stimuli.

Compare and Contrast

DISCRIMINATION VS. GENERALIZATION

Generalization is the opposite of discrimination. If an observer responds in nearly the same way to two different stimuli, then the observer is showing much generalization and little discrimination. On the other hand, an observer may respond differently in the presence of two different stimuli. Then the observer is showing ample discrimination and little generalization. The greater the discrimination, the less the generalization, and vice versa (i.e., if you have a lot of one, you have little of the other).

Usually when two stimuli are physically similar, considerable generalization will occur between such stimuli, and good discrimination (stimulus control) will be hard to establish. If two stimuli are completely different, there may be little stimulus generalization between them, and a good discrimination (stimulus control) will be established easily.

For example, suppose you know two sisters, Sally and Sarah, who are only a year apart in age. You may sometimes tend to confuse the two. In other words, you may respond to Sally with responses that have been reinforced by Sarah; for instance, you might call Sally "Sarah." Your reinforcement history with Sarah generalized to Sally. But they aren't that much alike, so the two sisters probably exert some stimulus control over your use of their names. Most of the time, you discriminate accurately between the two.

Now suppose, instead, that the two sisters are actually fraternal twins—probably more physically similar than ordinary sisters. That might generate more generalization and less discrimination between the two. Or suppose Sally and Sarah are identical twins who have the perversity of always dressing alike. They find it amusing to confuse their innocent and well-meaning friends. Now we're talking generalization city, not much discrimination, not much stimulus control anymore.

QUESTION

1. What's the difference between discrimination and generalization?

Concepts

STIMULUS DIMENSIONS AND FADING[4]

To understand the fading procedure, we first need to understand the concept of **stimulus dimensions**—the characteristics of stimuli. Often, we mean physical characteristics, such as roundness, smoothness, size, height, weight, luster, color, or shade.

Definition: CONCEPT

Stimulus dimensions

- The physical properties of a stimulus.

We also can think of stimulus dimensions in terms of the ways stimuli can differ from each other. For example, a house differs from an automobile along many obvious dimensions—size, shape, weight, material, and so on. The more dimensions along which objects differ, the easier it is to establish discriminative stimulus control. So it's easy to establish a discrimination between a house and an automobile. Rarely do you hop into your house and try to drive to school (probably you'd have trouble getting it into first gear because you couldn't find the clutch).

Similarly, the fewer the dimensions along which objects differ, the harder it is to establish discriminative stimulus control over our behavior. For example, it is not too easy to discriminate a good golf ball (S^D) from a bad one (S^Δ). The two golf balls are similar in so many dimensions and differ in only a few, subtle dimensions, like roundness, resiliency, and hardness of cover.

So to establish that discrimination, you might start with a good golf ball (S^D) and one that's not good (S^Δ). But to make the discrimination easier, you'd color the loser (S^Δ) green so that the student could easily discriminate between the good one (S^D) and the bad one (S^Δ), though on an irrelevant stimulus dimension. Then you'd gradually fade out the difference between the S^D and the S^Δ, fading the green to white. Eventually the only difference between the good and the bad golf ball would be roundness, resiliency, or hardness of cover. And that relevant stimulus dimension would be the only basis for the discrimination. Presumably the student would still be properly discriminating between the two balls, even though they were now the same color and the discrimination was much more difficult. The procedure you used is called **fading**.

Definition: CONCEPT

Fading procedure

- At first, the S^D and S^Δ differ along
- at least one irrelevant dimension,
- as well as the relevant dimensions.
- Then the difference between the S^D and S^Δ is reduced along all but
- the relevant dimensions,
- until the S^D and S^Δ differ along only those relevant dimensions.

QUESTIONS

1. *Stimulus dimension*—define it and give an example.
2. *Fading*—define it and give an example.

Example of Errorless Discrimination Behavioral School Psychology

TEACHING "READING"* (G-4)

Jimmy, the Child With Autism—Part XIV

Mae used the fading technique with Jimmy: First she and her staff showed Jimmy a card with the letters of his name on a white background; they also showed the name of another resident, Susan, on a card with the same style and color of lettering but on a black background.

They told Jimmy, "Pick up the card with your name." Then they reinforced the correct response with a raisin. Once Jimmy picked up the correct card on 40 trials, they removed his name from the white card and put it on one that was slightly less white, one that approached a light gray. Now the difference was still apparent. When he did 40 trials without any error, they changed the shade of the card to a slightly darker shade. They introduced a new shade each time Jimmy achieved 40 correct trials. In that way they faded the shades 11 times, until the card with the name Jimmy was the same black shade as the card with the name Susan.

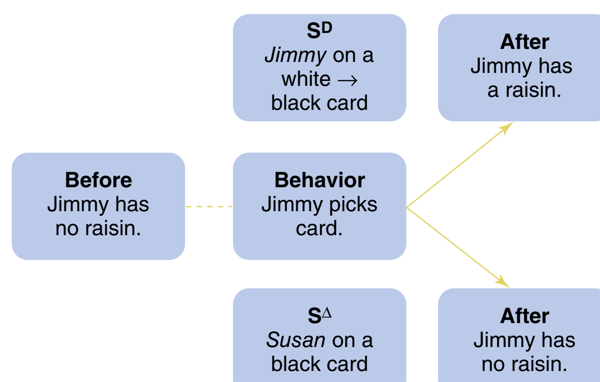
Fading initially involved making the two cards as dissimilar as possible along one dimension, the shade of the background. The other dimension in which the two cards differed was the lettering. The differences in lettering remained constant while the staff varied the darkness of the background. The results? At first, Jimmy's response came under the control of two very different stimuli—the shades of the two backgrounds. Then they decreased the differences in those two shades so slowly that Jimmy made no errors. Such a fading technique establishes a discrimination with no errors—an **errorless discrimination**, in which the subject makes the correct response without a single error in a discrimination-training procedure.

Definition: PROCEDURE

Errorless discrimination procedure

- The use of a fading procedure
- to establish a discrimination,
- with no errors during the training.

Reinforcement-Based Discrimination



QUESTION

1. *Errorless discrimination training*—define it and diagram an example.

KEEP IT SIMPLE

"OK, Kelli, now touch red, please."
"OK, Kelli, now touch green, please."

* Based on a case study by Donald L. Whaley with a girl from an institution for the developmentally disabled.

Kelli has no language, no verbal skills. So what you're saying sounds like a jumble of sounds that may be only slightly different. Imagine the only language you speak is English and someone speaks a couple of identical paragraphs of Japanese to you with only one slight difference, the Japanese words for red and green. You don't have a chance. Well, Kelli doesn't either. Give her a break. Just say:

"Red."
"Green."

By the way, this doesn't just apply with children who have language delays; if you have a typical preverbal kid whom you want to give a head start, use the same sorts of teaching procedures we've been talking about and keep it simple.

Don't embed the S^Ds in a bunch of gobbledygook. "But how's she going to know that I want her to touch them?"

Not by tossing a bunch of meaningless gobbledygook at the poor kid.

"But how will she learn what touch means?" Good question. Hang in and we'll get there later (Chapter 18).

QUESTION

1. Please explain the notion of keeping it simple when you're teaching early language skills to a child.

DUMBASS AWARD #2[5] (G-10)

Let me give a brief shout out to Gina Green for making me feel like a dumbass and thereby earning my second official Dumbass Award. Remember, she's not the dumbass; I am. Like Brian Iwata in Chapter 7, Gina gets the award for blowing my cool, for pointing out the obvious that I and most other hot-shot behavior analysts overlooked for so many years.

We're teaching Kelli to discriminate between red and green. To keep it simple, we will first teach red.

We put the red card on the table and say, "Red." And eventually she touches the red card every time—eventually scoring 100%, or almost. And, of course, she gets a "Good!" after every correct touch, occasionally paired with a Cheeto or whatever is her big reinforcer of the moment.

Then we start all over; we put away the red card and now just teach with the green card.

"Green." She touches it immediately. "Good." In fact she hits 100% in the first session. She's cool, we're cool, and now for the next session.

We put both the red and the green cards on the table, randomly switching their position from right to left every trial or so, and randomly giving the S^Ds "Red" and "Green," and she's fallen abruptly to 50%. She may be randomly moving from the red card to the green card or from the right side to the left side. Or she may be just touching the green card, because that was what we last trained her on. Or she may be just touching the right-hand card because she's right-handed and that's easiest.

"Kelli ain't cool!" No, she's cool; we ain't cool.

In our first two phases, the single-card phases, Kelli could bat 100% without listening to what we were saying and without even looking at the color of the card. She could have been deaf and color blind. But not in this third phase with the two colors presented simultaneously and the two vocal instructions presented successively.

We're trying to establish a very complex discrimination—a conditional discrimination. We're trying to establish the green card as the S^D for touching, conditional upon the S^D of our saying "Green" and the red card conditional upon our "Red." But we've failed the S^Δ test from the previous chapter (How soon we forget!): Is there also an S^Δ? If not, you don't have an S^D.

So if we want Kelli to attend to the color of the cards, we need to bag the first two phases and start right out with the two colors and the two words. And now we've got four complex stimuli, each composed of two components, the S^Ds ("Green" + green card) and ("Red" + red card). Kelli hears "Green" and looks until she sees the green card; that combination is an S^D for touching, and so on for the other S^D and the two S^Δs, like ("Red" + green card) is an S^Δ for touching.

So what does Gina Green have to with this? She pointed out the obvious, that you need at least two* S^Ds in order to teach such a discrimination. Obvious, now. Only a dumbass would try to do otherwise, but unfortunately many of us did and were, and many still do and are. But not you . . . right?

My students and I call it the **Gina Green Principle**: You need at least two S^Ds in order to teach a simultaneous discrimination. And periodically we review our many training procedures in our autism centers to make sure

* Actually, she says it is preferable to have at least three S^Ds to teach such a discrimination.

we're not blowing the Gina Green Principle. And every now and then we find one of those complex procedures that we hadn't realized failed the GG Principle. We've also turned Gina into a verb, as in, "Gina Green that procedure and make sure it's cool."

Thank you, Gina. Our kids are learning much better, because of you.

FOLLOWING DIRECTIONS

"But how will she learn what 'touch' means?" Training direction following is one of our last strongholds of dumbassery.

First I trained nose touching, keeping the directions, the S^D, simple:

"Nose." → Kelli touches her nose → Reinforcer (6 seconds of *Dora* on the DVD)

Of course, this involved a fair amount of response shaping until Kelli was actually touching her nose every time I said, "Nose."

Then I started teaching her to put both hands over her ears, every time I said, "Ears," because that would be just too cute for words. And what do you think happened? You've got it: Every time I said, "Ears," Kelli touched her nose. What a dumbass! Who, Kelli? No, no, of course not! Me! I'm the dumbass for failing to Gina Green it, for failing the Gina Green Rule—you need at least two S^Ds in order to teach such a discrimination.

I got so wrapped up in shaping Kelli's nose touching that I failed to anticipate that a little way down the road, we'd be working on simultaneously discriminating between "Nose" and "Ears."

What should I have done? From session 1, I should have randomly alternated between "Nose" and "Ears." It might have taken longer to get the "Nose" → Touches nose sequence trained, but it should have taken less time, overall, to train the two different S^Ds and responses all in the same teaching sessions.

QUESTION

1. Please explain the *Gina Green Principle* and the problems you'll have if you don't follow it.

TEACHING FOR COMPLEXITY AND GENERALIZATION

In these sections, we've been advocating that you keep it simple when working with the kids—simple S^Ds, simple conditioned reinforcers, hold on the descriptive praise. But that's panicked some of our Facebook readers: "You're going to restrict our kids to this simple world for the rest of their lives."

No, just don't complexify their lives before they're ready. You've got to build carefully from "click" to "Good" to "Good job hanging up your coat" to "Please hang up your coat and then get the *Principles of Behavior* book, you know—the one you find it so reinforcing for me to read you bedtime stories from."

Beware of naturalistic. Embrace unnatural. Doing discrete training trials with you and your little student sitting at the table seems so unnatural. And letting him run around the room, free as the wind, learning as the opportunity arises, occasionally tossing in a warm, loving smile and only rarely tossing in a Cheeto seems so natural, so healthy. But nothing about our lives is natural. Reading, writing, keyboarding, talking, and even Facebooking aren't natural. Natural is sitting in a cave with our Paleolithic ancestors scratching cooties. Embrace the unnatural. Embrace the structure of running learning trials with the kid at his table. But . . .

But then build in generality training. Systematically, not prematurely, increase the number of praise words, from "Good" to ah . . . how about "Cool." And from just you saying "Good" at his table to that big guy with the harsh voice saying "Good" on the playground, unless you are that big guy with the harsh voice doing the original training. Yes, do incidental teaching, but do not use naturalistic or incidental as an excuse for failing to do a careful behavior analysis of the skills you're trying to teach and failing to be very systematic in building your child's repertoire. (In fact, there's a carefully thought-out behavior-analytic approach to this issue called naturalistic teaching strategies, starting with the work of Hart and Risley that we described in Chapter 14.)

And once again, this is true, whether you're teaching your special-needs kid or your super-advanced kid.

QUESTION

1. Discuss how you should train for complexity.

In the Skinner Box
Experimental Analysis

STIMULUS-GENERALIZATION GRADIENTS[6]

Stimulus generalization is more or less the opposite of stimulus discrimination. On the one hand, we say two stimuli exert stimulus control to the extent that the individual responds *differently* in the presence of the two. For example, a pigeon might peck the key in the presence of the S^D and not in the presence of the S^{Δ}. This is **stimulus discrimination**.

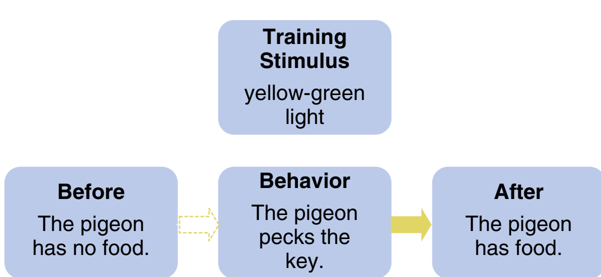
On the other hand, we say the stimulus control by one stimulus generalizes to another stimulus to the extent that the individual responds in the *same* way in the presence of the two stimuli. For example, suppose a pigeon has had considerable training with an S^D but little training with an S^{Δ}. Then the bird might respond at almost as high a rate in the presence of the S^{Δ} as in the presence of the S^D. This is **stimulus generalization**. The control of the S^D has generalized to the S^{Δ}.

Guttman and Kalish showed a similar sort of stimulus generalization in their classic experiment.

Training With Intermittent Reinforcement

During the training phase, these experimenters reinforced the key pecks of a pigeon in the presence of a training stimulus—a yellow-green light (a light with a 550 μm wavelength) that transilluminated (showed through) the pigeon's response key. (Note that the key light was always on in this experiment.) They used an intermittent reinforcement procedure in which they reinforced only an occasional response in the presence of the yellow-green light (a variable interval schedule of reinforcement). Most of the key pecks didn't get reinforced.

Training Procedure: Intermittent Reinforcement

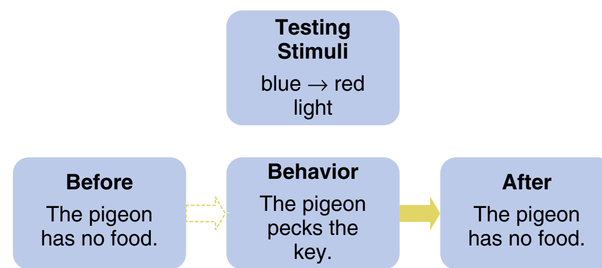


Note that we're not calling the training stimulus an S^D. Why? Because there was no S^{Δ}, (the yellow-green key light was always on) and we need an S^{Δ} in order to have an S^D. Remember?

Testing in Extinction

Once the pigeon responded reliably in the presence of that yellow-green key light, Guttman and Kalish tested for stimulus generalization using an extinction procedure with a set of test stimuli (a variety of novel light colors transilluminating the pigeon's key) in addition to the training stimulus (the original training color). This means that during testing no key pecks produced reinforcement. The experimenters presented their 11 different colors, blue to red, several times in a random sequence, with each one on for 1 minute before moving on to the next.

Testing Procedure: Extinction



You should understand that color (hue) is a natural stimulus dimension (the physical dimension is the wavelength of the light). And the colors are naturally arranged in a sequence. You can see that stimulus dimension by looking at a rainbow or looking at white light through a prism, which will give you a rainbow effect and arranges the colors side by side according to their wavelengths. For example, you will see that orange is closer to yellow-green than red is.

It is important to note that the testing procedure involved extinction—no reinforcement in the presence of any of the stimuli, either the training stimulus or the test stimuli. Why'd they do it that way? Why didn't they continue reinforcing the response in the presence of the training stimulus and extinguish in the presence of the test stimuli? To reduce the effects of discrimination training. *They wanted to measure the amount of "natural" stimulus generalization without the biasing or sharpening effects of stimulus-discrimination training.*

An alternative testing procedure might have been to intermittently reinforce all responding—the responding in the presence of the training stimuli as well as that in the presence of the test stimuli. But again, that training effect might bias the results too much and show too much stimulus generalization.

By the way, note that key pecking was not reinforced in the presence of the 10 testing colors while it was being reinforced in the presence of the original yellow-green training stimulus (in fact, the testing colors were not even presented during the training procedure; only the yellow-green training color was presented then). Therefore, we're still reluctant to call the yellow-green training stimulus an S^D or the 10 testing stimuli S^{Δ}s.*

Results

What do you think happened? The pigeons made progressively fewer responses as the colors were more and more dissimilar from the yellow-green training color. They responded most in the presence of the original yellow-green light, less with the yellow light, still less with an orange light, and least with a red light. Similarly, the response rate decreased as the colors went in the other direction from the original yellow-green, to green, to blue-green, and finally to blue (Figure 15.1).

Definition: CONCEPT

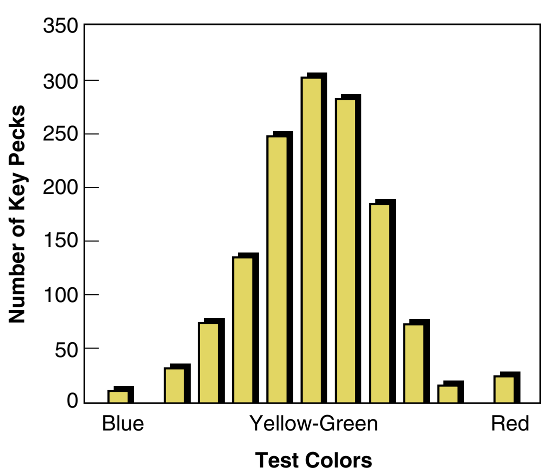


Figure 15.1 Stimulus-Generalization Gradient

Stimulus-generalization gradient

- A gradient of responding showing
- an increase in stimulus control
- as the test stimulus
- becomes less similar to the training stimulus.

The Guttman–Kalish experiment is typical of experiments on stimulus generalization: We reinforce a response in the presence of one stimulus. Then we measure the responding when we change some property of that stimulus. The greater the responding with the changed stimulus, we say the greater the stimulus generalization.

A stimulus-generalization experiment usually produces a **stimulus-generalization gradient**. Such gradients show that as some property of the stimulus becomes increasingly different from the discriminative stimulus used during reinforcement, the response rate decreases. In other words, the more dissimilar two stimuli are, the less the stimulus generalization and the better the discrimination. (*Gradient* refers to the extent that something changes, such as the *grade* of a road might become steep. A *stimulus-generalization gradient* refers to the extent that response rate changes when a test stimulus changes from the training stimulus.)

The pigeon's rate of responding decreased as the test stimuli became less similar to the yellow-green training stimulus. The test stimuli exerted less stimulus control.

QUESTIONS

1. For the pigeon experiment that shows stimulus generalization:
   a. Diagram the training procedure.
   b. Diagram the testing procedure.
   c. Draw a graph of the results.

   Danger: Study this section extra carefully, because students often mess up their answers to this question on the quiz.
2. *Stimulus-generalization gradient*—define it and give an example.

Compare and Contrast

AMOUNT OF GENERALIZATION VS. AMOUNT OF DISCRIMINATION

Look at the original gradient in Figure 15.2. It's the same one we showed for the original Guttman and Kalish experiment in the previous graph, but this time we used little squares for the data points and connected them with lines. In other words, this is a line graph rather than a bar graph. In addition, we added a hypothetical stimulus-generalization gradient—one we just made up.

* But don't be shocked if your instructor prefers a slightly different analysis.

1. Compared to the original gradient, does this hypothetical gradient show more or less stimulus generalization from the yellow-green training stimulus to the other test stimuli?
   a. more stimulus generalization
   b. less stimulus generalization
2. Compared to the original stimulus-generalization gradient, does this hypothetical stimulus-generalization gradient show more or less stimulus discrimination between the yellow-green training stimulus and the other test stimuli?
   a. more stimulus discrimination
   b. less stimulus discrimination

If you have less stimulus generalization between a training stimulus and a test stimulus, you have more stimulus discrimination; in other words, you have more stimulus control. *Amount of stimulus generalization is the opposite of the amount of stimulus discrimination (stimulus control)*.

The hypothetical gradient shows more discrimination and less generalization.

3. On the previous graph, draw a gradient that shows less discrimination and thereby more generalization.

Your stimulus-generalization gradient should be flatter.

Suppose we used a training procedure based on discrimination training instead of the training procedure Guttman and Kalish used (they exposed the pigeons to only the yellow-green light during training). In other words, we would alternate the yellow-green light with other colors, reinforcing key pecks in the presence of yellow-green and extinguishing in the presence of the other colors.

4. The yellow-green light would be an
   a. S^D
   b. S^Δ
5. The other colors would be
   a. S^Ds
   b. S^Δs
6. If we did use such a discrimination-training procedure, which gradient would we probably get? One like
   a. the hypothetical gradient we drew on the graph that showed more stimulus control?
   b. the flatter/fatter hypothetical gradient you just drew on the graph that showed less stimulus control?

Also, Guttman and Kalish wanted to see how responding to the test colors would be affected by reinforcement of responding to the yellow-green. They didn't want to see how well they could train the pigeon to discriminate between the yellow-green and the other colors, nor whether they could train the birds to respond as much to the other colors as to the yellow-green. So during testing, they neither reinforced responses to the yellow-green while extinguishing responses to the other colors, nor did they reinforce responses to the other colors. That way the responses to the other colors was pure generalization from the earlier reinforcement of responding to the yellow-green color. Whew!

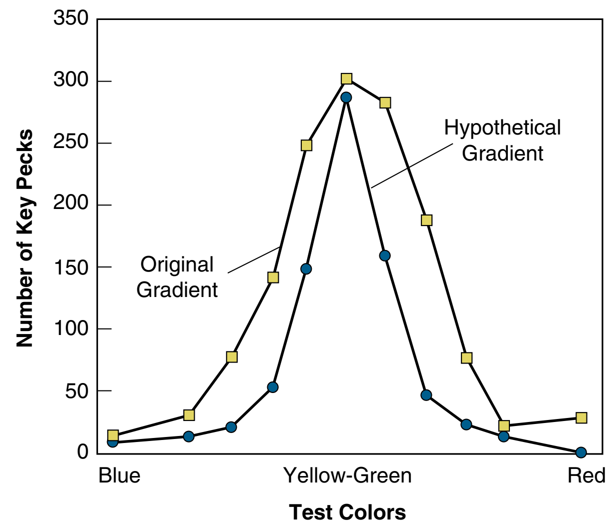


Figure 15.2 Stimulus-Generalization Gradient

QUESTION

1. Answer the preceding questions and you'll be so cool.

SCIENCE AND OBJECTIVITY

As no doubt you've read ad nauseam, in 1879 Wilhelm Wundt founded the first psychology laboratory, in Leipzig, Germany, thus starting our movement from psychology as a mere branch of philosophy to psychology as a natural science. And we psychologists have busted our collective butt ever since to become more and more scientific and gain the respect associated with that king of academic disciplines.

Wundt's big contribution was to bring psychology into the lab and make it an experimental science, where he could precisely control the independent variable—for example, the presentation of a flashing, colored light—and where he could objectively measure the physical characteristics of the independent variable. However, he still hadn't made the dependent variable objective: he couldn't objectively measure its physical characteristics; instead, he asked his research participants to introspect (to look within themselves) and describe their subjective experiences when they saw that objective, flashing, colored light. The problem with the reports of their subjective experiences was that we couldn't be sure the participants' reports were accurate. It was hard to be sure they weren't confused or even lying. We couldn't check.

But, following the tradition of E. L. Thorndike and Ivan Pavlov, in the early 1930s, B. F. Skinner started doing research with animals in his Harvard laboratory. And this helped him make the dependent variable objective, as Wundt had done with the independent variable: He couldn't ask his rats to describe their subjective experiences; instead, he counted their lever presses. And soon he was using an electromechanical device to record those lever presses—the ultimate in objectivity.

And, after that, we behavior analysts were on solid, scientific footing, with dependent variables that couldn't be contested—physical, electromechanical measures of our rats' lever presses and our pigeons' key pecks. No judgment needed; no room for deceptive, subjective bias that could influence the results of our scientific experiments. And behavior analysis was a natural science, for sure.

But in the mid-1950s, starting with Ayllon and Michael, behavior analysts began taking the principles of behavior from basic research with animals in places like Skinner boxes and using them in applied research with human beings in places like mental hospitals. At that point, it became more difficult to keep our scientific objectivity, especially with regard to the dependent variable. For example, should we count the sound Rod just made as crying or merely whimpering? Should we count Eric's forcefully putting the book on his desk as tantruming or merely his masculine way? Is Bob on task when he pauses for 120 seconds between words he's writing, even though he's not being disruptive? Sixty seconds? Thirty seconds? Suppose Mark merely makes a nasty face and glances at the hammer he'd earlier threatened Herb with; do we record that as an instance of aggression? Do we count that last tennis serve as correct? Or that dégagé in the ballet class? Was that a croak, or was it close enough that we can record that Andrew actually said "gum"? Is Melanie consistently talking loudly enough now, so we can consider our behavioral intervention a success?

Some of these dependent variables might seem as objective as the electromechanical count of key pecks, but when you and your partner independently record the responses, you'll be amazed at how often you disagree, for example, as to whether Melanie was talking loudly enough. It's often hard to get agreement between independent observers (interobserver reliability). But the requirement of this **interobserver agreement** (IOA) has been the behavior analyst's way of making many subjective dependent variables much more objective. That way we can be more confident that our results aren't biased, and we can be more confident that someone else would get the same results if they repeated our research—we can be more confident that even applied behavior analysis is still a natural science and not just a subjective mess of a pseudoscience.

Now, there are two senses in which a dependent variable can be subjective:

1. When we are not taking a physical measure of a publicly observable dependent variable and are instead relying on a human observer's judgment: for example, judging how loudly Melanie is talking. But can we make somewhat more objective our subjective measure of Melanie's loudness when we get good interobserver agreement? Not really, just more reliable. (Of course, if we used an electronic sound-level meter to measure the loudness of her speech, then we'd clearly have an objective dependent variable.)
2. The other sense in which a dependent variable is subjective is when observers report on their own private inner experiences or stimuli, their feelings, their thoughts, their private reactions (e.g., their subjective experience when seeing Wundt's visual stimulus).

There are two ways in which we might have no physical measure of a publicly observable dependent variable:

1. When it would be technically possible to get a physical measure but we don't, like when we don't use an electronic loudness meter to measure the loudness of Melanie's voice and use human-observer judgment instead.
2. When it would not be technically possible to get a physical measure, like when we measure the cuteness of Melanie's voice. There's no cute-ometer; you and I are going to have to decide how cute her voice is; we must make that subjective judgment, and work to get independent, interobserver agreement between our subjective judgments.

Definition: CONCEPTS

Subjective measure

- The criteria for measurement are not completely specified in physical terms
- or the event being measured is a private, inner experience.

Objective measure

- The criteria for measurement are completely specified in physical terms
- and the event being measured is public
- and therefore observable by more than one person.

Notice that deciding whether something is jazz is also subjective. (There's no jazz-ometer either, though for some of us whether our foot starts tapping is almost like a jazz-ometer.) So Fats Waller, Duke Ellington, and Herbie Hancock are going to have to get IOA on whether a particular CD belongs in your jazz collection or in your funk collection or in the trash can. In other words, subjective measures are essentially intuitive judgments, complex stimulus control. We peck the yes key when we agree that Melanie's voice is cute or Mark's glance and face making is aggression; and that's a form of complex stimulus control, just like the pigeon's pecking the yes key in the presence of a picture of a person or in the presence of a picture of a painting by Monet. And just as it took a lot of training with pictures of people and pictures of Monet's paintings for those stimuli to get reliable intuitive control over the pigeon's key pecks, it will often take a lot of training with instances of aggression, talking loudly enough, and cuteness to get reliable intuitive control over your measuring those dependent variables so that you and your partner can get high IOA scores.

QUESTIONS

1. *Subjective measure*—define it and give an example of each of the two reasons a measure might be subjective.
2. *Objective measure*—define it and give an example.
3. What's the role role of interobserver agreement in dealing with subjective measure? Give an example.

THE BEGINNINGS OF HEAVY-DUTY INTELLECTUALITY

We've looked at concept training and conceptual stimulus control. Now let's step back a minute and think about what we're doing. We're moving into something that looks a little like heavy-duty intellectuality. Much more subtle, much more sophisticated than light on, push lever, water; light off, push lever, no water.

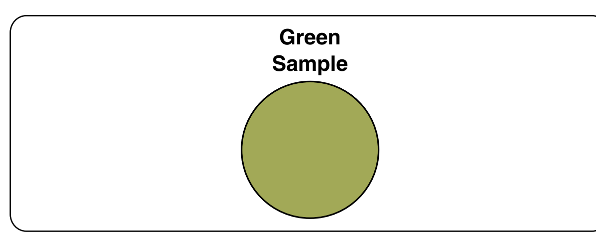
Conceptual stimulus control is a big intellectual deal. In this book, we cover over 200 concepts. And being able to write the definition when presented with a behavioral term is a big deal but pretty much on the same level as light on, push lever, water. However, being able to identify novel examples for each of the 200 concepts is a really big intellectual deal, way beyond light, lever, water. In fact, if you can correctly label examples of simple and complex human behavior with each of the 200 concepts, we're talking big-time PhD behavior-analyst material (i.e., big intellectual deal).

And, now we're going to look at matching to sample; we're going to move into more heavy-duty intellectuality. We're going to push the envelope a bit further.

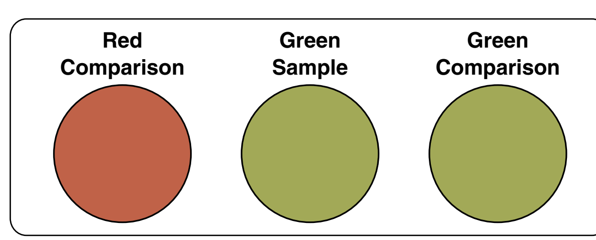
MATCHING TO SAMPLE

The Pigeon

Polly Pigeon pecks a response key, a plastic disk with a green light showing through it (the sample key).



Then two other response keys light up (the comparison keys), a green one on the right of the sample key and a red one on the left.



Polly pecks the green comparison key (the one that matches the sample key), and she gets access to a grain trough for 3 seconds (the reinforcer). Sometimes the sample key is green; sometimes it's red. Sometimes the green comparison key is on the right and the red one is on the left; sometimes they're reversed. Whenever Polly pecks the comparison that matches the sample, the response is reinforced; pecking the nonmatching comparison key is extinguished. Polly is **matching to sample**.

Definition: CONCEPT

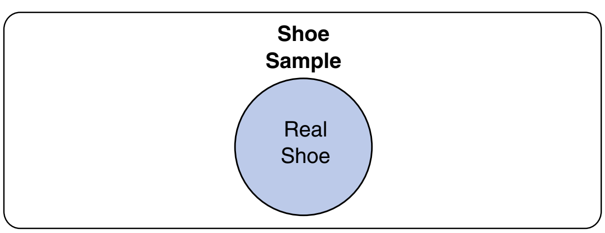
Matching to sample

- Selecting a comparison stimulus
- corresponding to a sample stimulus.

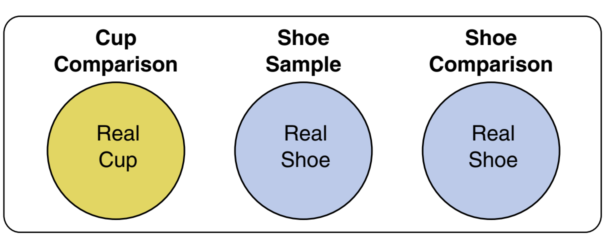
BEHAVIORAL SCHOOL PSYCHOLOGY

Jimmy, the Child With Autism—Part XV

Jimmy touches the running shoe (sample stimulus) lying on the table between him and Sue.



Then Sue puts two stimuli on the table—an identical running shoe and a cup (the comparison stimuli). One comparison stimulus is on each side of the sample-stimulus shoe.



Jimmy touches the comparison-stimulus shoe (he matches to sample), and Sue turns on 3 seconds of *Thomas the Tank Engine* (the reinforcer) for his correct matching to sample. Half the time, the cup is the sample stimulus. And also half the time, the positions of the comparison stimuli are switched.

As each set of stimuli come to control Jimmy's matching to sample, other stimuli are added, such as a doll and a spoon. Then Jimmy and Sue move on to pictures of the objects as the sample stimuli, keeping the real three-dimensional objects as the comparison stimuli. They also move on to stimulus-class matching; for example, the sample stimulus is the running shoe and the matching comparison stimulus is a dress shoe (both types of shoe are in the same stimulus class—shoes). Cool, huh?

And they move on to puzzles. First the sample stimulus is the cutout in the board in the shape of Bunny, and Jimmy picks up the cutout Bunny from the set of four comparison-stimulus animals. He then turns Bunny (comparison stimulus) until it really matches the cutout in the board (sample stimulus), and he puts Bunny home. Yes, we're still in the matching-to-sample business.

Step by step, Jimmy is acquiring the skills that may someday allow him to be a student in a regular-education classroom. And one of those steps is an even more complex, more subtle form of matching to sample. Now Jimmy puts puzzle pieces in a rectangular frame with no internal guides, eight pieces, each 3 to 4 inches in width, with random, wavy cuts that form a simple picture when he properly fits them all into the frame.

Nothing's automatic, nothing's easy; but step by step, Jimmy is making big progress.

The Regular-Education Preschooler

The four colored blocks lay in a row: red, green, yellow, and blue (they combine to form the sample stimulus). Rachel has four other colored blocks that she arranges in the same red-green-yellow-blue sequence (she is now constructing the comparison stimulus). She has just matched to sample, and she has just completed one item on an IQ test for preverbal, preschool children.

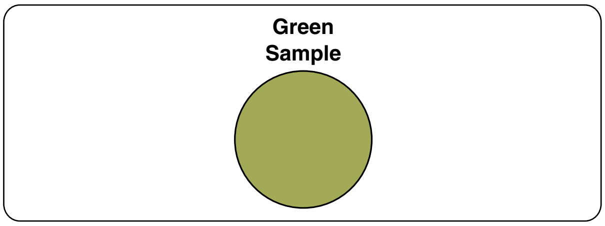
The College Student

The red stripes form a complex geometric pattern on the white background, with one part missing (this complex geometric pattern is the sample stimulus). Four comparison stimuli lie below the sample stimulus; these four stimuli are different geometric forms. Sue touches the comparison stimulus that would complete the complex pattern in the sample stimulus. She has just matched to sample, and she has just completed one item on an IQ test for verbal adults.

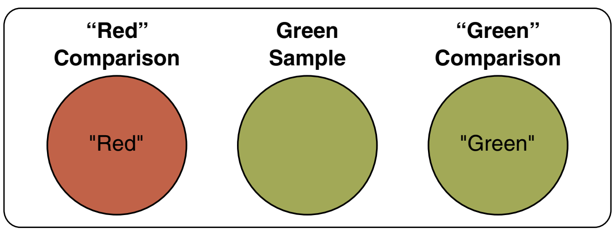
The mysterious IQ test is nothing more than a set of learned skills ranging from simple to complex.

The Pigeon (Advanced Course)

Polly Pigeon pecks the green-lighted sample key.



Then the comparison keys light up, one with the word *green* and the other with the word *red*.



Now Polly is doing ***symbolic matching to sample***—*matching to sample in which the relation between the sample and comparison stimuli is arbitrary*. For Polly, the relation is arbitrary because we could just as well have reinforced her matching the words *squig* and *squag* with the green and red lights. We don't want to say Polly's reading because reading involves much more complex stimulus control, but superficially, it sure looks like it, doesn't it? Ain't Polly cool?! (When the sample and comparison stimuli are physically identical, as in our earlier examples, it is sometimes called ***identity matching***.)

QUESTION

1. *Matching to sample*—define it and illustrate it:
   a. in the Skinner box
   b. with an autistic child
   c. in an IQ test

GRAMMAR CHECKS AND CONDITIONAL DISCRIMINATIONS

A few minutes ago, I wrote, "Consider sex, drugs, and rock and roll; *their* excellent examples of hedonic reinforcers." But I should have written "*they're* excellent examples of hedonic reinforcers." I should have written the contraction for "they are" which is "they're."

So what's going on here? I said to myself, "they're excellent," but that's just sound. I didn't spell it out, "t-h-e-y-'-r-e." So the sound "they're," however you spell it, is an S^D for the typing of three different words, *they're*, *their*, and also *there*. And for which spelling it's an S^D is **conditional** on the rest of the sentence, e.g., *They're cool. Their coats. There it is*. But unfortunately, the sentence I'm saying to myself often fails to have ***conditional*** $\boldsymbol{S^D}$ ***control*** over my typing; I often type the wrong word. And I also often screw up *it's* and *its*.

Please don't tell me I'm the only one with that problem.

This is really complex stimulus control. Just like matching to sample: Whether Polly Pigeon should peck the green or the red key is conditional on the color of the sample key she's matching. And whether I should type *their* or *there* is conditional on the rest of the sentence. Whew! Got it?

QUESTION

1. How are some of Dick's typos a result of poor *conditional* S^D *control*.

EVERYDAY LIFE: A CONCEPT CONTROL PROBLEM

Mae: Jake, you look so handsome, in your new suit, I just can't resist you.

Juke: Jake! My name's Juke! Mae, what are you doing; dreaming about your old boyfriend, Jake? That really hurts.

Mae: No, Juke; I'm so sorry. It's been forever since I've even thought of him. Really. It's just simple response induction (response generalization); it's just because Juke and Jake are pronounced almost the same. Juke, I really am sorry. I know the difference between you and him; he was a complete jerk, and you're a complete winner. Really. . . . Juke, come back!

I sympathize with poor Mae, even more than with poor Juke. And I can also empathize with Mae; twice, in typing the previous paragraph, I accidentally typed *Jake* instead of *Juke*, simple response induction. But for Mae, I think it might be more complex. Mae might have made that mistake even if her old boyfriend's name were *Tyrone*; she might have said, *Tyrone, you look so handsome*. . . . Why? Because both Juke and Tyrone would belong to the same overarching concept—*boyfriend*—regardless of whether Tyrone was a present or past boyfriend and regardless of whether she currently loved him, the overarching concept was *boyfriend*. And that overarching concept of boyfriend was somehow preventing the more specific concept of Juke from controlling Mae's response.

Even though I've spent hours thinking about this, I'm not sure I understand how it happens, so I'm more than open to your suggestions.

But, in any case, have you ever made that error with a rather complex, subtle concept like *boyfriend* or *girlfriend* or your two children? Show me a mama who has a couple of kids, who hasn't called one of her kids by the other's name, who hasn't had that problem with the overarching concept *her children*, whom she dearly loves, interfering with her saying the right name. You show me such an errorless mama, and I'll have your hearing checked.

By the way, a Facebook friend said that her mama sometimes mistakenly called her by the name of their much-loved family dog! My friend wondered what that conceptual stimulus class was.

Notes

1 Based on Herrnstein, R. J., & Loveland, D. H. (1964). Complex visual concepts in the pigeon. *Science*, *146*, 549–551. For a simple procedure with which students can replicate the original Herrnstein and Loveland results, using simple apparatus that should cost no more than about 10 bucks and is easily done in an undergraduate lab, you might check out the following: Malott, R. W., & Siddall, J. W. (1972). Acquisition of the people concept in pigeons. *Psychological Record*, *31*, 3–13. Please send us a note if you tried this experiment and let us know if it worked out.

2 Eshleman, J. (Ed.). (1995). Animals—everyone' s a critic: Breakthroughs in science, technology, and medicine. *Discover*, *16*(5), 14. (Thanks to John Eshleman for abstracting this article and sharing it on the Behavioral Bulletin Board of CompuServe).

3 Watanabe, S., Wakita, M., & Sakamoto J. (1995). Discrimination of Monet and Picasso in pigeons. *Journal of Experimental Analysis of Behavior*, *63*, 165–174.

4 This section is based on Whaley, D., & Welt, K. (1967). Uses of ancillary cues and fading techniques in name discrimination training in retardates. *Michigan Mental Health Research*, *1*, 29–30.

5 Green, G. (2001). Behavior analytic instruction for learners with autism: Advances in stimulus control technology. *Focus on Autism and Other Developmental Disabilities*, *16*, 72–85.

6 Guttman, N., & Kalish, H. I. (1956). Discriminability and stimulus generalization. *Journal of Experimental Psychology*, *51*, 79–88.

PART IX

Complex Processes I

CHAPTER 16

Imitation

Behavior Analyst Certification Board 5th Edition Task List Items		
G-4.	Use stimulus and response prompts and fading (e.g., errorless, most-to-least, least-to-most, prompt delay, stimulus fading).	Pages 298–301, 303–306
G-5.	Use modeling and imitation training.	Throughout

Example of Imitation
Behavioral Special Education

TEACHING IMITATION TO A CHILD WITH AN INTELLECTUAL DISABILITY[1] (G-4) (G-5)

Marilla was a 12-year-old girl with a profound intellectual disability who lived at the Firecrest School in Seattle. Marilla would only make an occasional grunting sound. She responded only to a few simple vocal commands, such as *Come here* and *Sit down*. She didn't begin to walk until she was 7 years old. She was 12 before she could dress and feed herself and before she was toilet-trained. She had reasonable hand–eye coordination and could make simple responses, such as turning a knob or opening a door.

Once, when Dr. Donald Baer visited the Firecrest School, a staff member pointed out Marilla to him. "Dr. Baer, we've done everything we can for this little girl, but I'm afraid that it isn't much. She doesn't seem able to learn anything. I wonder if your reinforcement techniques could help her."

He and two grad students, Robert Peterson and James Sherman, tried to help Marilla. At first, the behavior analysts spent a few days observing Marilla. For example, they played with her on the ward for several hours. In the course of this play, they repeatedly asked her to imitate simple responses, such as hand clapping and waving. Marilla always failed to imitate, yet they had observed her making some of these responses at other times. They concluded that Marilla could not imitate. They thought Marilla's lack of imitative skills might account for her painfully slow learning of functional behaviors. Imagine how hard learning would be for a child who couldn't imitate.

Definition: CONCEPT

Imitation

- The form of the behavior of the imitator
- is controlled by
- similar behavior of the model.

Intervention

On the first day of the intervention, one of the grad students worked with Marilla just before her lunch hour. He said, "Do this," and raised his arm. Marilla just stared at him. The behavior analyst repeated this several times, but Marilla made no response.* Finally, he **physically prompted** her response: He said, "Do this," and raised his arm once more, but this time also took Marilla's hand and raised it for her. Then he said "Good," and gave her a spoonful of her lunch.

* If we were teaching imitation today, we probably would only give the model once (or twice, at most) before providing physical prompting. But Baer and company wanted to make sure that Marilla's problem wasn't just lack of attention—that she really couldn't imitate, even when given several opportunities in a row.

Definition: CONCEPT

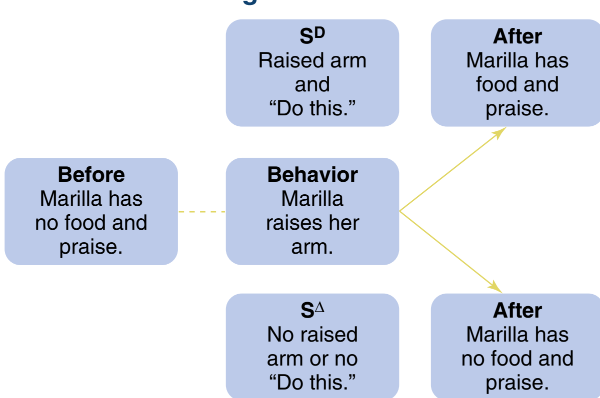
Physical prompt (physical guidance)

- The trainer physically moves the trainee's body
- in an approximation of the desired response.

After several trials with physical prompts, he began to reduce his assistance gradually: He only partially raised Marilla's arm, requiring her to raise it the rest of the way. And when she did so, he reinforced her response. He reduced his help until Marilla made an unassisted arm-raising response. Then he gave her a bite of food and said, "Good." Occasionally Marilla would raise her arm even when he had not done so. On these occasions, he didn't reinforce the response, and it gradually extinguished. Eventually she raised her arm only when he said, "Do this," and raised his arm.

Thus far, we have shown a simple discrimination. In the presence of the S^D (the behavior analyst's saying, "Do this," and raising his arm), a response occurred (Marilla raised her arm), and he reinforced that response (presentation of food and praise). In the presence of an S^Δ (the behavior analyst's saying nothing and not raising his arm), he didn't reinforce the response (Marilla's raising her arm).

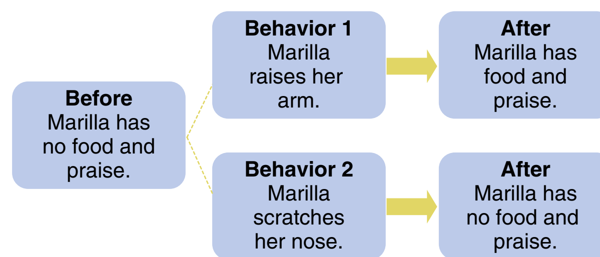
Imitation Training: Stimulus Discrimination



But discrimination training isn't the whole story. There's also response differentiation. Marilla not only had to respond at the right time, but she also had to make the right response. So the behavior analysts reinforced only her arm raises and not, for instance, her nose scratches. They used differential reinforcement of arm raising.

After Marilla's arm raising was under good stimulus control and well differentiated, the behavior analyst used the same discrimination training and response differentiation techniques to establish several other imitative responses. The next one consisted of his tapping a table with his left hand whenever he said, "Do this." When he first introduced a new imitative S^D, some shaping and physical prompting was necessary. But he made less and less use of shaping and physical prompting, as part of the response-differentiation procedure, on each successive response. By the time they got to the seventh new response, Marilla had just finished imitating nose tapping. Then he said, "Do this," and for the first time tapped the arm of a chair. Marilla immediately imitated that response by also tapping the arm of the chair. She had made this particular imitative response though he had never reinforced that particular response. Reinforcement of previous imitative responses had *generalized* to this new response.

Imitation Training: Differential Reinforcement



Definition: CONCEPT

Generalized imitation

- Imitation of the response
- of a model
- without previous reinforcement
- of imitation of that specific response.

Marilla had finally shown one instance of **generalized imitation**.* The behavior analysts breathed a sigh of relief. They had needed to establish only seven imitative responses before generalized imitation occurred. Maybe now the rest would be easier going. To continue Marilla's acquisition of generalized imitation, the trainer moved on to the next

* The first definition of *imitation* we might call *regular imitation* or *reinforced imitation*, to contrast it with *generalized imitation*. But we're inclined to leave it as just plain old *imitation* with the understanding that we mean *reinforced imitation*. Also note that we could define **generalized imitation** as *the behavior of the imitator is under stimulus control of the behavior of the model and matches the behavior of the model, without previous reinforcement*. But that's too long and cumbersome, even for us. So we hope you understand that *imitation of the response of a model* says the same thing.

response. He tapped the table's leg and waited several seconds for Marilla to do the same. Nothing happened. After 10 seconds had elapsed with no response from Marilla, he went through the sequence of responses Marilla had previously learned. Again he reinforced each imitative response he had previously reinforced and eventually got back to the response of tapping the table's leg. But Marilla still wouldn't imitate it. They still had a long way to go. Marilla would need much more training before establishing reliable, generalized imitation.

They returned to guiding and shaping the response. They had to establish two more imitative responses before observing another instance of generalized imitation. Marilla had just imitated the response of extending the left arm. Now the behavior analyst began making a circular motion with that arm for the first time. Marilla immediately imitated this motion. They then went through the sequence of imitative responses Marilla had learned. The behavior analyst reinforced all those responses he had previously reinforced, but he was careful not to reinforce tapping the chair or making the circular motion with her arm. Both of these generalized imitative responses maintained; they didn't extinguish in spite of repeated non-reinforced occurrences intermixed with the reinforced imitative responses. Maybe the match of Marilla's behavior to other people's is becoming a powerful, conditioned reinforcer for her just like it is for us (remember from Chapter 12?)!

Then he said, "Do this," and stood up. But, once again, it was necessary to shape the imitative response. In fact, it wasn't until the 23rd new response that a new imitation again occurred without reinforcement. That imitative response consisted of tapping the shoulder. The percentage of new responses that Marilla correctly imitated without reinforcement on the first demonstration gradually increased. After she had imitated about 120 different responses, she imitated all the new responses without reinforcement. Some responses were more interesting than the earlier ones. They consisted of such things as scribbling, placing geometric forms on a form board, crawling under a table, flying a toy airplane, and burping a doll. Though they used reinforcement and shaping for many responses, near the end of the study Marilla required only a few trials before she could perform most of the responses, whereas at the beginning of the study, they had to use much shaping, physical prompting, and reinforcement for each new response. It took an average of over three sessions to establish each of the first 10 new responses, but after establishing 20 responses, each response required an average of less than half a session. This rapid rate of acquisition of new imitative responses remained fairly consistent for the remainder of this phase of their intervention.

Then they attempted to establish more elaborate sequences of imitative responses called **behavioral chains**. Initially, they worked with only two-response chains. (See Chapter 19.) The behavior analyst working with Marilla that day would make two responses such as raising his left arm and then standing up. Then he reinforced Marilla's imitation of the same sequence of two responses. After Marilla mastered the two-response chains, they gradually increased the number of responses in a single chain to as many as seven. Marilla could correctly imitate these long sequences after only 10 hours of reinforcement of the various response chains. At times, some response chains even contained new responses that Marilla had not previously performed.

When Marilla could imitate almost any new motor response, they began working on her verbal behavior. At first, the behavior analyst said, "Ah." He repeated this several times and also tried several other vocal responses interspersed with the usual motor responses. Marilla always imitated the motor responses but never the vocal responses. The training of imitative motor responses didn't seem to generalize to imitative vocal responses, though Marilla did occasionally make grunting noises. (Incidentally, for her dissertation Breanne Hartley Crooks found that children often showed some generalization from the imitation of playing with toys to the imitation of movements and even to the imitation of spoken words![2])

The behavior analysts would have to shape the vocal response; they would have to reinforce successive approximations of vocalizations. They included vocal responses in a response chain composed mainly of motor responses. The first time they tried this, the behavior analyst said, "Do this," then rose from his chair, walked to the center of the room, turned toward Marilla, said, "Ah," and returned to his seat. Marilla immediately jumped up from her chair, walked to the center of the room, turned toward the behavior analyst, and then made a strange facial expression vaguely resembling the model's when he said, "Ah." But no vocal response was forthcoming. That was all right; the facial expression was a step in the right direction, and they reinforced it. On successive trials, the facial expressions became more and more like the model's, and eventually she began to emit vocal responses. They continued to reinforce responses that more and more closely approximated the model's vocal response until Marilla was saying, "Ah," like an expert. The chain of motor responses became shorter and shorter. Eventually, the model was able to remain in his seat and say, “Do this,” followed by “Ah,” and Marilla would imitate the vocal response.

In this way, they shaped imitations of simple sounds, combined them into longer or more complex sounds, and finally combined them into usable words. After 20 hours of imitation training of vocal responses, Marilla was able to imitate such words as “Hi,” “Okay,” “Marilla,” and the names of some objects.

After Marilla’s imitative repertoire was considerably larger, they presented her with new people as models to determine whether she would imitate their behavior. She did. She imitated the behavior not only of other males but also of females as well as she had imitated the original models. And this is a big deal; it’s not going to be too functional if Marilla only imitates a couple of her behavior techs.

Incidentally, Bob Peterson, one of the grad students who worked on this project, continued working with Marilla for his doctoral dissertation. Bob proposed to a faculty committee that he would teach Marilla 20 responses using imitation training and 20 other responses using other procedures; then he would compare the effects of various variables on both of these response classes. One professor, who was not sufficiently familiar with the effectiveness of the principles of reinforcement, objected. Because he had so much trouble teaching normal college students anything, he thought it would be impractical to take the time necessary to teach a child with an intellectual disability so many new behaviors. Bob replied that with imitation stimuli and reinforcement, he expected to take only an hour or two. This impressed the skeptical professor. It turned out that Bob’s prediction was correct. He showed Marilla what to do, and she did it—just like any bright kid!

Analysis

You may ask what maintained Marilla’s imitative behavior. Being the shrewd student of behavior analysis you are, no doubt you suspect that food and social reinforcement are the main factors. A reader with less understanding of the problem than you might say, “That’s silly. The whole purpose of this study was to show that you could get generalized imitation without reinforcement.” “Of course,” you would reply, “But you fail to understand the subtleties of the issue at hand.”

In fact, these behavior analysts showed that Marilla could perform *specific* imitative responses without direct reinforcement of those *specific* responses. *But reinforcement of some other imitative responses must occur before the unreinforced imitative responses occur*. They reinforced some imitative responses so that imitative stimulus control could generalize to other unreinforced responses. And it would probably be best if Marilla’s imitative responses were occasionally reinforced by the staff, even though she was showing more reliable imitation without explicit reinforcement. The extra reinforcement from the staff would supplement the natural reinforcement contingencies for imitation that were in the environment. We’ll talk more about these natural contingencies in the next section.

QUESTIONS

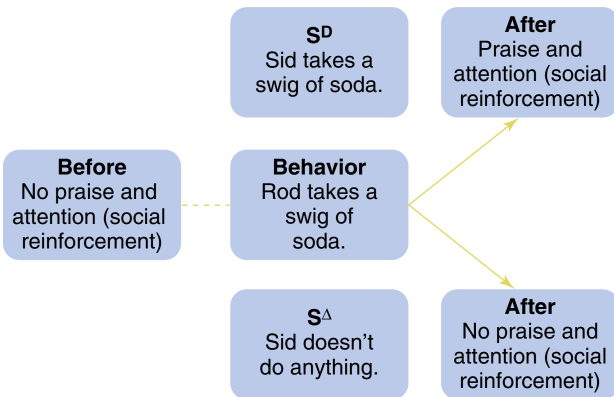
1. *Physical prompt*—define it and give an example.
2. *Imitation*—define it and give an example. (Make the example one that is not an example of generalized imitation.)
3. *Generalized imitation*—define it and give an example.
4. To train imitation, we need both a discrimination contingency and a differential reinforcement contingency.
   a. true
   b. false
5. Why?
6. Diagram the contingency for establishing imitation for a child who previously showed no imitative stimulus control.
7. Also describe how you would establish generalized imitation for such a child.
8. To get generalized imitation, we must reinforce some imitative responses.
   a. true
   b. false
9. How would you show that you have achieved generalized imitation?

ADDED VS. BUILT-IN CONTINGENCIES FOR IMITATION

In Marilla’s case, the behavior analysts added a contingency to reinforce imitation. Let’s look at another example of an added contingency and then at a different sort of contingency for imitation.

Imagine a commonplace scene between parents and children: Sid takes a swig of soda from a can. Rod watches, then he takes a swig of soda from the can. Sid pats Rod on the back and praises him (an added reinforcement contingency). This may be the main way imitation is learned; the behavior of the imitator (Rod in this case) is reinforced by someone else (Sid) if it's similar to that behavior of the model (Sid).

Added Reinforcement Contingency for Rod's Imitative Behavior



In this case, the model's behavior (Sid's swigging the soda) is an S^D in the presence of which similar behavior of the imitator (Rod's swigging) is more likely to produce the added reinforcer (Sid's praise and attention).

But a built-in reinforcement contingency is also present—the sweet taste of the soda when Rod takes a swig. And it may be built-in contingencies like this that are responsible for our maintaining our strong imitative repertoires. When someone makes a particular response and gets a reinforcer, there's often a good chance we'll get a similar reinforcer if we make a similar response. And that's one reason why learning to imitate is such a big deal.

QUESTION

1. Give an example of an added contingency for imitation and an automatic, built-in one.

Example

USING EXCESSIVE IMITATION TO ESTABLISH NORMAL LANGUAGE SKILLS[3]

As we walked down the hospital corridor, we heard a high-pitched voice singing:

Go tell Aunt Rhody.
Go tell Aunt Rhody.
Go tell Aunt Rhody
The old gray goose is dead.

When we turned the corner, we saw that the singer was a 7-year-old boy. This is Dicky, a child with autism. As you'll read in Chapter 18, Wolf, Risley, and Mees saved Dicky's eyesight by training him to wear his glasses. And sure enough, Dicky was still wearing his glasses. We were pleased to note that he was now so well adjusted that he walked down the hall singing happily. We walked after him. We wanted to chat with him to see how he had been getting along during the last few years. We shouted after him, "Wait a minute, Dicky; we want to talk to you."

Dicky stopped singing but kept walking. He began chanting with gradually increasing vigor. "Wait a minute, Dicky; we want to talk to you. Wait a minute, Dicky; we want to talk to you! Wait a minute, Dicky; we want to talk to you!"

This alarmed us; so we ran up to him and put our hand on his shoulder. "What's the matter, Dicky?"

He stopped walking and began stamping his feet, on the verge of tears. "Want a spanking. Want a spanking! Want a spanking!! Want a spanking!!!"

This really bothered us. We had thought Dicky was in good shape, but we were wrong. Our efforts to console him had no effect; fearing we might be reinforcing this undesirable behavior, we left Dicky.

A few months later, we had a chance to check into Dicky's case. We found that the hospital staff had once again called Todd Risley and Mont Wolf to help Dicky. At first, they observed that Dicky never requested anything, never asked questions, never made comments. Even though he sometimes imitated other people's behavior, he didn't imitate when asked to do so. So they started by trying to get rid of his inappropriate imitation, while maintaining appropriate imitation.

Describing Simple Past Events

As with Marilla, the work with Dicky took place during mealtimes, so they could use food as a reinforcer in addition to social praise. A ward attendant worked with him. On the first day, she held up a picture of Santa Claus and **verbally prompted**, "This is Santa Claus. Now say 'Santa Claus.'" No response. Then she held up a picture of a cat and said, "This is a cat. Now say 'cat.'" Still no response. After she had presented all five of her pictures, she mixed them in a different order and went through them again. Each time she named the picture and asked Dicky to do the same.

Definition: CONCEPT

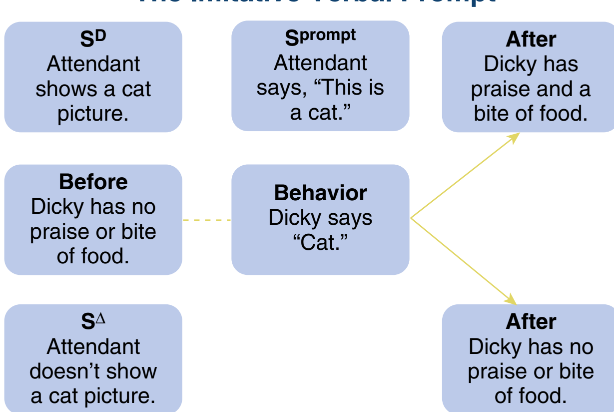
Verbal prompt

- A supplemental verbal stimulus
- that raises the probability of a correct response.

Finally, on the third time through the sequence, the attendant showed a picture of the cat and verbally prompted, "This is a cat. Now say 'cat.'" Dicky's response: "This is a cat. Now say 'cat.'" That wasn't exactly what the attendant had hoped for, but it was good enough for a beginning. She immediately said, "Good boy," and gave him a bite of his meal. The reinforcement worked. Dicky began imitating more and more often. After a week of reinforcement, he was imitating practically every verbal prompt and also everything the attendant said during the reinforcement sessions. But she reinforced only those imitative responses that occurred at appropriate times—when she asked for them. And she didn't reinforce imitative responses she had not asked for.

Dicky's verbal responses came under the control of the attendant's spoken words, but the pictures seemed irrelevant. Dicky rarely even bothered to look at them. Instead, he twisted and turned in his seat. To bring Dicky's verbal behavior under the stimulus control of the pictures, the attendant used a ***time delay***: She held the picture for several seconds before giving the verbal prompt. If Dicky correctly named the picture before she presented the prompt, he got a bite of food more quickly than if he waited until after the prompt.

The Imitative Verbal Prompt

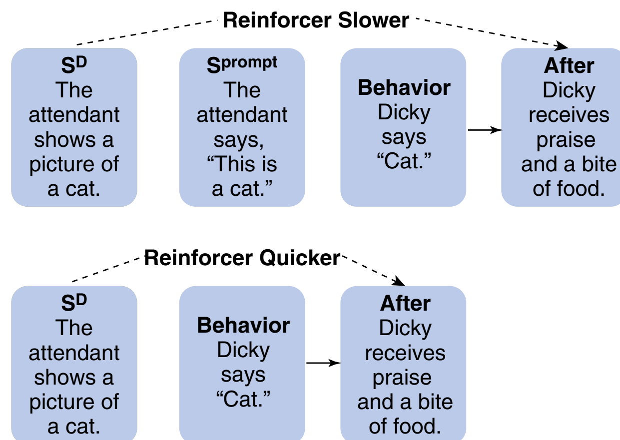


(Notice that, in this diagram, we slid the S^D and S^Δ to the left in order to squeeze in the S^{prompt}.)

Now, you might ask, why doesn't Dicky always wait until the attendant gives the prompts? "This is a cat." That prompt reliably controls Dicky's saying, "Cat." So why would showing the picture of the cat come to control Dicky's saying, "Cat"?

Because this is a form of differential reinforcement of answers with short latencies. Because, of course, Dicky will get the praise and food sooner after the attendant shows the picture if he responds immediately than if he doesn't respond until after the attendant's prompt of "This is a cat."

Differential Reinforcement of Short Latencies



(This diagram of differential reinforcement is almost the same as the diagram of the imitative verbal prompt, just changed slightly to make our point clearer—we hope.)

But with the time delay, Dicky's naming objects gradually came under the control of the pictures without verbal prompts. Within 3 weeks of reinforcement, Dicky's verbal behavior was under appropriate stimulus control of 10 different pictures. The attendant then started training Dicky with common household objects and pictures, and he began to name them with increasing ease.

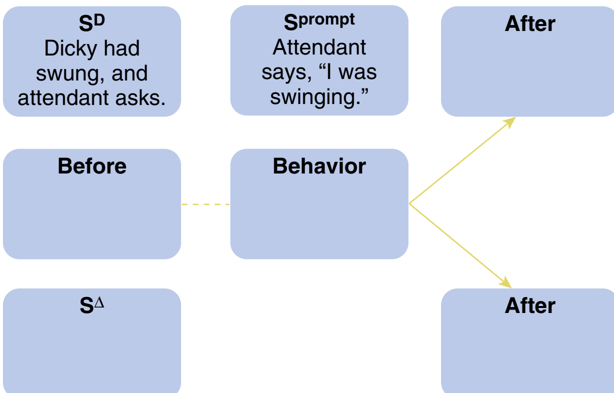
Describing Complex Past Events

Though Dicky's performance was impressive, there's more to verbal behavior than naming pictures and objects. One of the main advantages of verbal behavior is that we can talk about things no longer present. How could we use reinforcement to get Dicky's verbal behavior under the control of stimuli outside of his immediate environment?

To tackle this problem, the attendant would take Dicky outside to play on the swing or sliding board. Then she would bring him back inside and ask, "What did you do outside?" If he didn't respond in a few seconds, she used an imitative verbal prompt for his response by saying, "I was swinging." Then she would reinforce Dicky's imitation of this prompt stimulus (S^{prompt}).

1. Please complete the diagram for this contingency.

The Imitative Verbal Prompt



(Note: Be careful with the S^Δ; it's tricky. Note that the S^D has two necessary components, Dicky's swinging *and* the attendant's asking. So the absence of *either* of these components constitutes an S^Δ.)

Eventually, Dicky began answering the questions *before* the attendant had presented the imitative verbal prompt; naturally, these quicker answers got reinforced sooner after the attendant's question than those that didn't occur until she had presented the prompt. On trials with these quicker answers, the contingency diagram would be just like the preceding one except there would be no S^{prompt}.

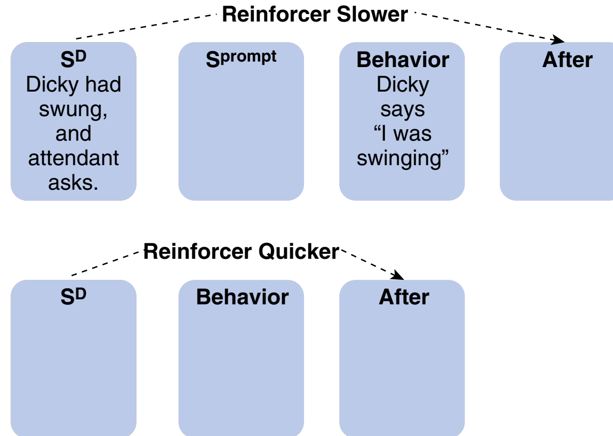
This is a form of differential reinforcement of answers with short latencies.

2. Please complete this diagram.

As a result, Dicky gradually answered more and more quickly, until he rarely waited for the prompt and was, thus, answering in a more normal manner.*

Dicky also began to answer other questions such as, "What is your name?" or "Where do you live?" If he didn't answer the question, the attendant would provide a verbal prompt and reinforce the correct imitative response.

Differential Reinforcement of Short Latencies



After several weeks of training, Dicky's imitation of verbal stimuli increased notably, although much of his behavior was still unusual. He would sometimes imitate the questions before answering them, and he would often reverse his pronouns; for instance, he would ask for a drink by saying, "He wants some water."

When Dicky left the hospital, his parents continued the training (something we now recognize as an important feature of effective training of children with autism). After about 6 months with his parents, Dicky was using pronouns perfectly and was initiating many requests and comments, although he was still making inappropriate imitative responses. He attended a laboratory preschool at the University of Washington for 2 years. Many of the procedures at this preschool involved the principles of reinforcement. After 2 years there, his verbal skills had improved to the point that he was ready for special education in the public school.

At that point, Dicky's verbal behavior resembled that of a skilled 5-year-old. This means his rate of learning language had been approximately normal since this intense behavior-analysis training. After that, the naturally occurring reinforcers for normal verbal behavior appeared to maintain and expand his verbal repertoire.

This is one of a growing number of examples where behavior analysts have used reinforcement techniques over a long period of time with a person having severe learning problems. Dicky is now able to function almost normally. Since this pioneering research, many others, especially Ivar Lovaas and his students, have used similar interventions with great success.

* You are deserving of praise for being such a thoughtful student, if you're puzzled by our using Dicky's having swung as part of the S^D, even though, a couple chapters ago, we said the S^D shouldn't precede the opportunity to respond by more than 60 seconds. In truth, we've taken a little poetic license; what we really have is a rule-governed verbal analog to an S^D. That such analog S^Ds exert stimulus control over Dicky's behavior shows that he is far advanced in acquiring a normal verbal repertoire.

QUESTIONS

1. *Verbal prompt*—define it and give a clear example.
2. Diagram a contingency showing how you can use verbal prompts to take advantage of excessive imitation and establish more normal verbal behavior under more normal stimulus control.
   - Do such a diagram for a procedure for establishing control by stimuli that are present.
   - Do such a diagram for a procedure for establishing control by stimuli or events that are not present.
3. In both cases, diagram the procedure for differential reinforcement of short latencies.

THE IMPORTANCE OF IMITATION

Being able to imitate is so important that it's almost the first thing we teach children with autism as we use behavior analysis to help them acquire a normal repertoire and set of values. Not that it's so important in its own right, but as you will see, it's crucial to language learning. And you would probably never have even learned to tie your own shoes if you hadn't first learned to imitate. Imagine what it would be like trying to teach nonverbal kids how to tie their shoes without imitation. Any skill you've acquired more complex than scratching your butt probably required your being able to imitate before you could acquire those more complex skills.

Example of Imitation

THE INVASION OF THE ADVERTISERS FROM OUTER SPACE

"Your Sovereign Mistress of All Creatures in the Universe."

"Yes, my loyal Wizard."

"We have still not dominated one planet."

"We missed one? How can that be?"

"I've been trying, but they're holding out."

"What is the name of this reluctant planet?"

"They call it the planet Earth."

"Oh, yes. I've heard of it."

"With your generous permission, Your Sovereignty, I would like to try a new tactic. I stole it from some of Earth's most brilliant strategists."

"What is it?"

"They call it the domino theory."

"I haven't heard of that."

"If I can weaken and then knock over the strongest nation, the United States, then all the other countries will topple right over."

"But how can you weaken such a powerful country?"

"With an even more powerful drug—if only we can trick them into taking the drug."

"The drug's your lever to topple the first domino?"

"Yes. I have calculated that with this drug we can sap the nation's wealth at well over $50 billion per year."

"That much money could make a big dent in our intergalactic debt!"

"With this drug, they will start slaughtering each other at well over 25,000 per year, especially the ones who are young and strong."

"You make even me shudder."

"I plan to introduce over 95% of them to this drug before they graduate from high school."

"Clever."

"Soon over 12 million of them will be addicted."

"You say this is a strong nation? It must be a stupid nation. How will you get them to take this terrible drug? Will it taste good?"

"No. I've tried it. It tastes terrible. We need lots of sugar or something."

"Then they can't be so dumb as to take it."

"It costs money to make money."

"I should have known you were getting to that. How much?" And the Sovereign Mistress reached for her purse.

"$4 million or more."

"To manufacture this drug?"

"No, to pay athletes to consume it on TV. The kids spend more time watching TV than they do going to school."

"And?"

"To fill the magazines, newspapers, and internet sites with ads, especially the ones college kids read."

"And?"

"I will tell them they are not cool if they do not take the drug. College students believe anything."

"You have to be kidding. They can't possibly be that stupid."

"Trust me. It is so easy to program these people.

And here is my best trick."

"Yes?"

"To throw them off the track, I will start a rumor that taking the drug results from moral weakness, not the $4 million I spend on advertising each year."

"They won't believe it."

"With all due respect, Your Sovereignty, they will after a while. Then I'll change the rumor. I'll program them to believe that it's due to an inherited factor X."

"If they fall for that crap, they deserve to be the first domino to topple. What will you call this magic drug that will consume over $50 billion of their income and over 25,000 of their lives every year?"

"I will name it after our planet."

"Alcohol?"

The statistics are real; and it ain't no joke. If I wanted to weaken the United States, I'd say, "Have another Dos Equis. If the Most Interesting Man in the World drinks beer, why shouldn't you?" Isn't imitation* wonderful? Two hundred and fifty million sheep can't be wrong. Baahhh, baahhh.

HOW DO YOU KNOW IF IT'S REALLY IMITATION?

Remember our definition of **imitation**: *the form of the behavior of the imitator is controlled by similar behavior of the model*. In this definition, the *form of behavior* usually refers to the topography of the response.**

When we say the *form of the behavior of the imitator is controlled by similar behavior of the model*, we mean the behavior of the imitator is similar to the behavior of the model because of experience with a special reinforcement contingency. In this history with the special reinforcement contingency, behavior of the imitator has been reinforced contingent on similarity to the behavior of the model. For example, when the mother says, "Mama," the baby says, "Mama." Then the mother showers the baby with reinforcing, enthusiastic affection. The mother is reinforcing the behavior, at least in part, because of the similarity to her own behavior.

When defining imitation, we do *not* just mean that the behavior of the imitator is similar to the model's behavior. It would not be imitation if the similarity were because both the imitator's behavior and the model's behavior were controlled by the same contingency.

For example, it would not be imitation if in the presence of a very loud noise, the presumed imitator and the model both put their hands over their ears. The same contingency, escape from the loud noise, would be maintaining both behaviors. The removal of the aversive condition (the loud noise) in this negative reinforcement contingency wouldn't necessarily depend upon the similarity of their behaviors.

* Note that this is a special type of imitation, ***delayed imitation***, where the imitative behavior occurs a considerable time after the modeled behavior. In other words, if you do imitate the Most Interesting Man's beer drinking, there will probably be a considerable delay between the time you see him drink the beer and when you actually drink the beer yourself. The process underlying such delayed imitation may be fairly complex: There might be some form of rule-governed analog to imitation, where the next day you say, I think I'll have a Dos Equis, so that sharks can have a week dedicated to me. But it also might be real imitation, a type of generalized imitation.

** The form of most nonvocal behavior is easy to see (overt). The form of vocal behavior is somewhat covert, but the results of the response can be observed (in other words, we can hear the sound). The observability of a response is generally assumed when imitation occurs. However, there can be imitation where the similarity is the product of the response, rather than the form, as when you imitatively whistle a tune someone just played on a guitar.

So, to be sure you have imitation, you must show that the behavior of the imitator is under the stimulus control of the behavior of the model. In other words, you must show that the similarity of their behaviors is not under the control of some third factor. We say people *imitate* the behavior of a model when their behavior resembles that of the model, and changes in the behavior of the model produce similar changes in the behavior of the imitator.

Theory

GENERALIZED IMITATION

We've presented a *definition* of generalized imitation—imitation of the response of a model without previous reinforcement of the imitation of that specific response. And we've pointed out that generalized imitation occurs only if some other imitative responses are being reinforced. Now we'd like to present a *theory* of generalized imitation—an explanation of why reinforcement of some imitative responses maintains other imitative responses that we are not reinforcing.

You might ask, why do we need more explanation; why do we need a theory of generalized imitation? Aren't we just talking about simple stimulus generalization? Reinforce the pigeon's pecks on the green key and you'll get generalized pecking on the yellow-green key, right? Stimulus generalization. Reinforce Marilla's imitation of nose tapping and you'll get imitation of chair tapping, right? Stimulus generalization?

Yes and no. You get chair tapping, and you haven't reinforced it, but that doesn't always result from simple stimulus generalization. We can't know for sure with Marilla, but in other studies the behavior analysts have asked the kids which imitative responses would get the added reinforcers and which would not. And the kids knew. They might say, "You give me a bite of food when I tap my nose right after you tap your nose. But you don't give me anything when I tap my chair right after you tap your chair." In other words, *the kids kept on making unreinforced imitative responses, even though they knew that subset of responses wouldn't be reinforced by the behavior analyst*. The kids weren't confused, but they showed generalized imitation anyway. Why? That's the question this theory of generalized imitation addresses. We need a theory to explain why we get generalized imitation even when the imitator knows the experimenter will provide no added reinforcers contingent on such generalized imitation.

Definition: THEORY

Theory of generalized imitation

- Generalized imitative responses occur
- because they automatically produce imitative reinforcers.

Marilla's behavior matches the model's. This correct imitation automatically produces visual and internal stimuli—Marilla's seeing and feeling her behavior matching the model's. These automatic, imitative, reinforcing stimuli reinforce Marilla's imitating new responses that have never been reinforced by the behavior analysts.

However, before we go on with this theory, let's pause for a brief review.

Definition: CONCEPT

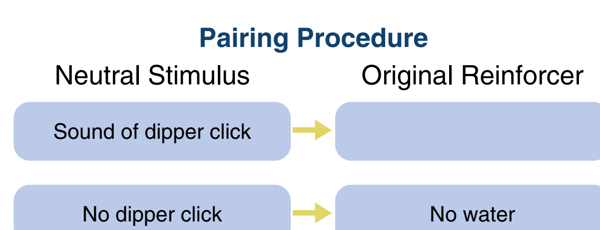
Imitative reinforcers

- Stimuli arising from the match between
- the behavior of the imitator
- and the behavior of the model
- that function as reinforcers.

REVIEW

How to Establish Conditioned Reinforcers

Remember our definition of **conditioned reinforcer**: *a stimulus that is a reinforcer because it has been paired with another reinforcer*. For example, every time Rudolph the Rat presses the response lever, you dip the water dipper into the water reservoir, and as you bring up the dipper for Rudolph to drink, the metal dipper clicks against the bottom of the Skinner box. And when there's no click, there's no water.



So you're pairing the sound of the dipper click with the water reinforcer. In that way, the click becomes a conditioned reinforcer.

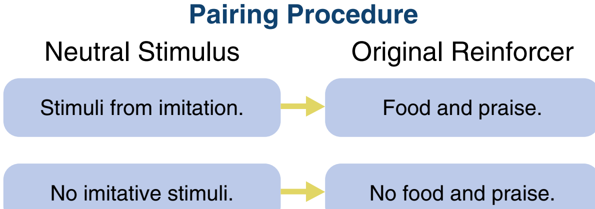
You can now use the click to shape a new response—for example, chain pulling. You dangle a chain from the roof of the Skinner box, and every time Rudolph approximates pulling the chain, you click the water dipper. However, now you don't lower the dipper all the way into the reservoir, so all Rudolph gets is the click and a dry dipper. But because you pair the click with the water reinforcer at other times, the click keeps its reinforcing value and reinforces Rudolph's successive approximations to chain pulling.

In summary, you paired the click with an existing reinforcer—water. This pairing caused the click to become a conditioned reinforcer. Then you used the conditioned reinforcer to reinforce new behavior. Now let's go back to the theory of generalized imitation.

How to Establish Conditioned Imitative Reinforcers

You established a conditioned reinforcer for Rudolph by pairing the click with water. In the same way, the behavior analysts established a conditioned **imitative reinforcer** for Marilla, by pairing the stimuli resulting from imitation with a bite of food and some praise. For Marilla, the stimuli were the sights and the feelings of her muscles (proprioceptive stimuli) that resulted from her seeing and feeling her behavior match the model's.

Pairing Procedure

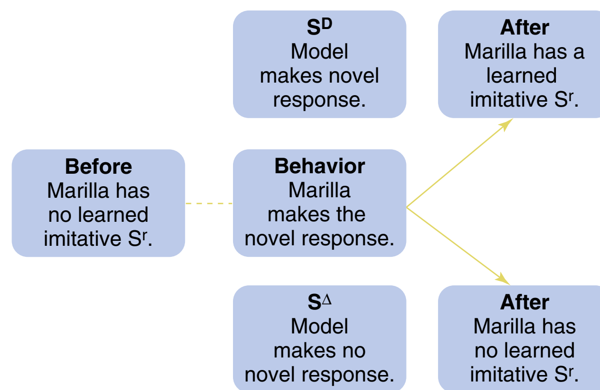


Remember, that, as we pointed out in Chapter 12, the pairing procedure actually involves two pairings: If we pair a neutral stimulus (stimuli from imitation) with an original reinforcer (food and praise), logically that means that the absence of that stimulus is paired with the absence of that reinforcer. Please keep this in mind when you generate your own examples of the pairing procedure or deal with them on quizzes. But now back to Marilla.

The behavior analysts had to go out of their way to establish the imitative stimuli as conditioned reinforcers. But these stimuli automatically followed Marilla's imitating the model; the behavior analysts didn't themselves present those stimuli. So once the imitative stimuli had become conditioned reinforcers, these conditioned, imitative reinforcers automatically followed each of Marilla's correct imitations. This means that even a novel imitation will automatically produce a conditioned imitative reinforcer (the stimuli arising from Marilla's seeing and feeling her behavior matching that of the model).

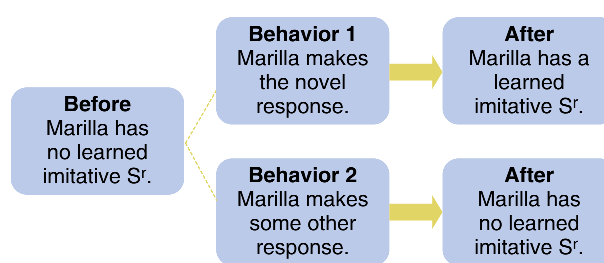
Remember that to train imitation, we need both a discrimination contingency and a differential reinforcement contingency. And also, to maintain generalized imitation, we need both a discrimination contingency and a differential reinforcement contingency:

Generalized Imitation: Discrimination Contingency[8]



So the **theory of generalized imitation** states that Marilla's generalized imitative responses occur because they automatically produce conditioned, imitative reinforcers—stimuli arising from the match between her behavior and the model's.

Generalized Imitation: Differential Reinforcement



QUESTIONS

1. *Imitative reinforcer*—define it and give an example.
2. Diagram how we establish conditioned imitative reinforcers.

3. *Theory of generalized imitation*—define it and give an example.
4. For generalized imitation, diagram:
   a. the discrimination contingency
   b. the differential reinforcement contingency
5. Why do we need a theory of generalized imitation?

Verbal Behavior (Language)

IMITATION AS A PREREQUISITE TO LEARNING LANGUAGE

Rod's first birthday party. The family gathers to watch the birthday boy cram his first piece of chocolate cake into his mouth. Dawn says, "Sid, get the camera."

"Cama," imitates Rod.

"Got it," says Sid.

"Goggit," imitates Rod.

"Let's give him the cake," says Dawn cutting a slice.

"Cake!" imitates Rod.

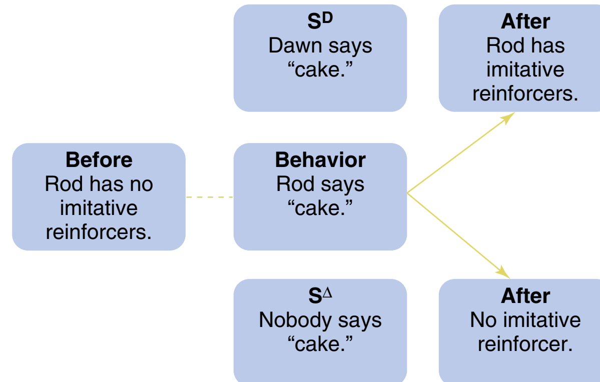
Everybody laughs, and Dawn hugs Rod.

You have already seen that sound is an unconditioned reinforcer, and we've suggested that this unconditioned reinforcing property of sound may be responsible for babies' initial babbling. And we've said that babies' babbles are gradually shaped into the sounds of their own language. This occurs because the sounds of their own language are conditioned reinforcers that differentially reinforce the behavior that produces them.

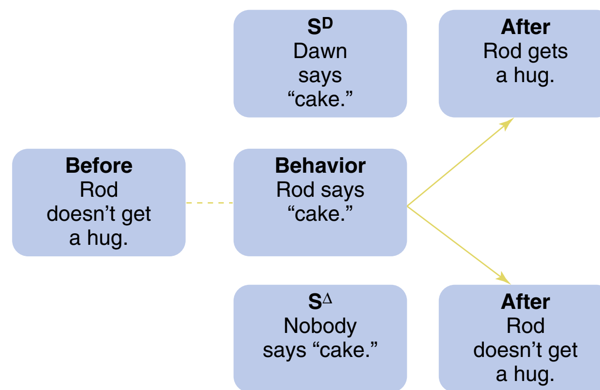
Now get ready for a really difficult distinction. We've just said that babies sound like their parents because the sounds themselves are *simple* conditioned reinforcers. Now we are going to say that babies also sound like their parents because they are imitating their parents, because the sounds are *imitative* conditioned reinforcers. And imitative conditioned reinforcers involve a little more special training than simple conditioned reinforcers.

A child's imitation of a parent's vocal behavior can be maintained in two ways (*these are the two main causes of imitation mentioned earlier in the chapter*):

- First, the imitative vocal response produces conditioned imitative reinforcers just as many other imitative behaviors in the past produced imitative reinforcers.



- Second, the vocal imitative behavior may be reinforced by social or other reinforcers.



So, as Rod is learning language, his extensive imitative repertoire is essential. We've seen that children who fail to acquire an imitative repertoire have a hard time learning desirable behaviors, in general. Now we see how important an imitative repertoire is to learning verbal behavior, in particular. Without a generalized imitative repertoire, imitative verbal responses are not likely to occur. (If Rod didn't have a generalized imitative repertoire, he probably wouldn't have said "cake" when Dawn said "cake.") If imitative responses should happen to occur, they aren't reinforced by imitative reinforcers. Without a generalized imitative repertoire, the match between Rod's and Dawn's behavior wouldn't be reinforcing.

Where there is an absence of imitative reinforcers, there will be an absence of generalized imitation. The only way for imitative responses to be strengthened in the absence of imitative reinforcers is for each response to be reinforced by an added contingency. We've seen added reinforcement contingencies can increase imitative behavior (as in the case of Marilla). Unfortunately, parents rarely use intensive added reinforcement contingencies until after nonimitative children have great verbal deficits.

QUESTIONS

1. What are the two main causes of a child's imitating vocal behavior?
2. Why is generalized imitation crucial for language learning?

GENERALIZED IMITATION OF INAPPROPRIATE BEHAVIOR

Three-year-old Rod said, "Good boy" to his teddy bear, a favorite remark of Sid and Dawn. What's going on here? Has Rod become the youngest behavior modifier in history? No. And Rod's saying, "Good boy" surprised Dawn and Sid. They hadn't explicitly taught him to say that.

It just means generalized imitation is ever present. The imitative reinforcer of the match between Rod's behavior and his parents did the trick. But the real kicker came when Rod surprised his parents by spontaneously imitating Sid's swearing. And, unfortunately, it was hard not to act shocked and maybe even laugh whenever Rod said the bad words, at least the first few times. And that just added fuel to Rod's little foul-mouthed fire. This is not just a strained, hypothetical example; over the years, several cute little not-quite-verbal kids with autism would say the foulest of foul words in our early-behavioral-intervention preschool, much to their parents' horrified embarrassment.

Research Methods

AN ADEQUATE CONTROL CONDITION TO SHOW REINFORCEMENT

Suppose your behavior-analysis teacher invites you and a friend to his home. Further, suppose your friend hasn't had the enlightening experience of reading this book. During the course of an hour's chat, you observe your teacher's 5-year-old daughter. Like all behavior analysts' children, she is extremely charming and seems to be one of the happiest people you have ever seen (yeah, right). While not being boisterous or unruly, she is amused, entertained, and fully content. You also observe that, like most behavior analysts, your teacher takes great pleasure in his child and expresses it by often showering upon her attention, affection, love, and an occasional piece of delicious fruit.

You can't help but notice that the behavior-analyst parent only delivers these reinforcers after the child has made some happy sort of response. Your naïve friend is amazed at the happy home life. But you, knowing your teacher is a strong advocate of reinforcement principles, had expected nothing less. You explain to your friend that "happiness is not a warm puppy . . . happiness is a group of reinforced responses." Your teacher is intermittently reinforcing his daughter's behavior of behaving happily and having a good time.

Your friend points out that you don't reinforce happiness; happiness just happens. This skeptic asserts that happiness will be more likely to happen in a warm, loving home—just what the behavior analyst is providing. You counter this notion by saying that a warm, loving home is not enough. What is important here is presenting warmth and love immediately after occurrences of happy behavior.

You both agree that warmth and love may be crucial factors. You know they must immediately follow the desired happy responses. Your friend argues that the particular child's behavior that the father's love and warmth follow is beside the point. Your friend says it doesn't matter when you show warmth and love; it just matters that you show it. How would you go about resolving this disagreement?

Right you are: You would perform an experiment. But just what sort of an experiment would you perform? Someone less skilled in scientific research than you are might suggest a simple extinction control procedure. In other words, you would stop giving the supposed reinforcers of love, warmth, and so forth, and see if the frequency of happy responses decreased.

As you know, the simple extinction control procedure wouldn't do. If you simply withheld love and warmth, you would predict that happy responses would decrease in frequency, and your friend would make the same prediction. Your friend would say that when you take love and warmth from the house, happiness, of course, goes with them.

As you knew all along, you would need the potential reinforcer present in the situation. But you must make sure it doesn't occur immediately following a happy response. In other words, if the love and warmth are still there, the friend will argue that happiness should remain. On the other hand, because love and warmth no longer immediately follow happy behavior, you will argue that happiness will be on its way out.

What you would have to do is wait until times when the child wasn't being happy. Then you'd shower the kid with love and warmth. You'd do this over a period of several days. Your friend would predict that happiness would remain because the love and warmth remained, even though it was no longer contingent on happiness. But you would predict that the happiness would drop out because the reinforcers of love and warmth were no longer contingent on happy behavior.*

QUESTIONS

Danger: Study this section extra carefully, because students often screw up the following questions on their quizzes.

1. Why isn't extinction the best control procedure for demonstrating reinforcement?
2. What is?

* Another common control condition is variable-time stimulus presentation, where you present the presumed reinforcer randomly, independent of the occurrence of the response. When possible, however, it might be even better to use the procedure of this section, because presenting the reinforcer when the response is not occurring will prevent accidental reinforcement of that response. And also, it is a form of DRO (differential reinforcement of other behavior), so you might see an even more rapid decrease in the frequency of the response than with variable-time reinforcement.

Notes

1 Based on Baer, D. M., Peterson, R. F., & Sherman, J. A. (1967). Development of imitation by reinforcing behavioral similarity to a model. *Journal of the Experimental Analysis of Behavior*, *10*, 405–415.

2 Hartley, B. K. (2013). *A molecular analysis of training with multiple vs. single-manipulations to establish a generalized manipulative-imitation repertoire* (Unpublished doctoral dissertation). Western Michigan University, Kalamazoo, MI.

3 Based on Risley, T., & Wolf, M. (1967). Establishing functional speech in echolalic children. *Behavior Research and Therapy*, *5*, 73–88.

CHAPTER 17
Avoidance

Behavior Analyst Certification Board 5th Edition Task List Items

B-4.	Define and provide examples of positive and negative reinforcement contingencies.	Throughout
B-6.	Define and provide examples of positive and negative punishment contingencies.	Throughout

Example

BEHAVIORAL MEDICINE

Sidney Slouch Stands Straight[1]

The Problem

Juke stood silently in the doorway of Sid's office. Sid did not see him. He sat with his elbows on his desk, his head in his hands. Juke stared at his friend for a couple of minutes before he spoke; then he said gently, "What's happenin', Sid?"

Sid raised his head slowly but didn't look directly at Juke. In spite of his tinted glasses, Juke thought Sid's eyes looked red. "What's happenin', Sid?" Juke repeated.

"Not much."

"You look bummed out, man."

"I'm depressed." Sid still didn't look at Juke.

Juke moved into Sid's office, closed the door, and sat down in a tattered, but comfortable, stuffed chair in the corner. "So what's bringing you down?" Juke asked.

After a few moments of silence, Sid said, "It's my students. I bust my tail for them, and they don't appreciate it. I thought we were friends. Even my best student, Joe."

"I know you work hard, and I'm sure your students appreciate it too," Juke said.

"They wouldn't talk about me the way they do if they appreciated me."

"What do they say?"

"They call me names."

"Names? What do you mean?" Juke asked.

"I overheard Joe, and Sue, and Max talking. And they were talking about 'the Slouch.' It took a minute before I realized they were talking about me! That's an awful thing to call anyone."

Juke strained to suppress a smile. He thought about when he and Sid had been freshmen at Big State University, 10 years ago. People had called Sid "the Slouch" even then. But maybe they'd never called him that to his face. Of course, they were right. He had the worst posture on campus, and it had gotten worse. At a distance, he looked almost like an old man.

As if he'd read Juke's thoughts, Sid added, "Of course, they're right. My posture isn't perfect. But you'd think they'd have more respect for me than . . . I wish I could improve my posture, but it's so unnatural to stand straight. Even when I try, I forget to stay straight. And there I am again—the Slouch. You can't change a lifetime's bad habits." Sid stared at his desk.

"What is that, Sid, some new principle of behavior? You can't change a lifetime's bad habits? That's about as dumb as, 'It took you a long time to get into such bad shape, so it'll take you a long time to get back into good shape.' Some kind of simple-minded poetic justice? Good posture is just behavior, and you're a behaviorist. So get it together."

"Don't hassle me!" Sid said.

Juke thought, I deserve that. I forgot one of Dale Carnegie's major general rules: When people have troubles, they value sympathy more than solutions. So Juke backed off, gave Sid a good dose of sympathy, and then returned to his general rule: Don't complain about problems; solve them. Juke gradually talked Sid into taking his problem to his wife, Dawn. Dawn was the practical behavior analyst in the family; Sid was the theoretician.

The Solution

Sid and Dawn sat at their breakfast table that Saturday morning, searching for a solution. Dawn said, "The first question is: What's the response we want to manage or modify?"

"My slouching, of course."

"I'm not so sure," Dawn said. "For you, slouching may be the absence of a response. When you don't do anything special, you naturally fall into your old slouch."

"OK, then my response is standing straight," Sid said.

"So we've got to come up with a reinforcer for the response."

"Having a Clint Eastwood posture and avoiding people laughing behind my back doesn't seem to do the trick."

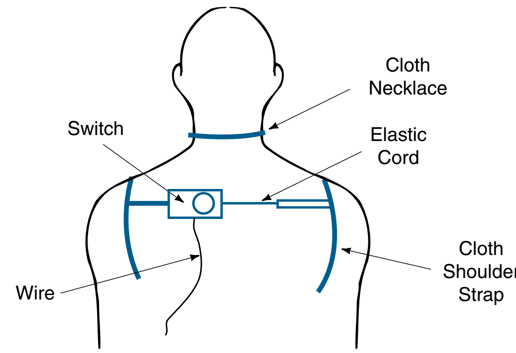
"Because no one instance of standing straight makes that much difference. Standing straight for one minute won't turn you into Clint Eastwood, and it won't prevent people from hurting your feelings," Dawn said.

"Well, we can't have someone give me an M&M every time I stand tall."

"No, we need some sort of automatic reinforcement procedure, and it should be with you all the time. Let me check through the back issues of *JABA*."

Dawn leafed through the cumulative index of the behaviorist's bible, the *Journal of Applied Behavior Analysis*. She found the solution in a research report Dr. Nathan Azrin and his colleagues had published when they had been at Anna State Hospital in Anna, Illinois.

With the help of the apparatus technician at Big State, Dawn and Sid built a harness that Sid strapped around his torso.[2]



The back section consisted of an elastic cord cut in half and then fastened to a snap switch. The snap switch was activated whenever Sid stopped standing or sitting in an erect way. Whenever he stopped maintaining his good posture, his shoulders would round, stretch the elastic cord, and activate the switch. The switch, in turn, activated a moderately loud tone, a negative reinforcer for most people, at least when they are in a social situation (like electronic flatulence). They also arranged a 3-second timer, so that when Sid would stop maintaining his posture, he'd hear the soft sound of the timer clicking on and then, 3 seconds later, the aversive tone.

The Results

So far, the procedure's been working well. Before the behavioral intervention, Sid usually slouched. When he wears the slouch apparatus, he avoids slouching almost all the time. When he removes the apparatus, he still avoids slouching much of the time* (Figure 17.1). He hopes that after a while

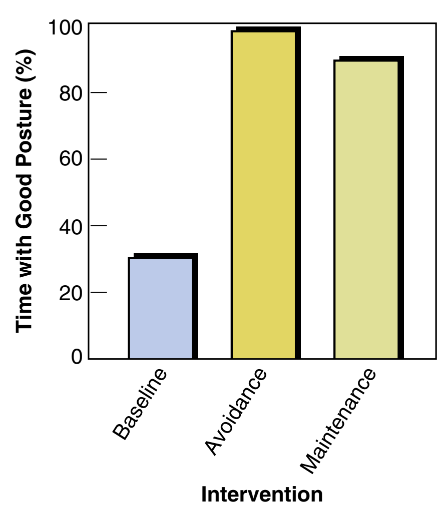


Figure 17.1 Avoidance of an Aversive Tone by Maintenance of Good Posture

* Heavy-Duty Discussion Topic: Why does this avoidance behavior maintain so well when the avoidance contingency has been

he will be able more or less to stop wearing the apparatus and maintain his good posture. But even if he has to keep wearing it, wearing the behavioral apparatus is much less of a hassle than the rigid back brace that many people use to maintain a good, healthy posture.

Concept

AVOIDANCE CONTINGENCY

Let's look again at the Slouch—we mean Sid—and the contingencies of the behavioral intervention. We can view the procedure Azrin and his team developed as a special type of negative reinforcement contingency—an **avoidance contingency**. Sid avoided the presentation of the aversive tone by maintaining a good posture—standing and sitting straight.

Before	Behavior	After
Sid will hear a loud tone in 3 seconds.	Sid straightens up.	Sid won't hear a loud tone in 3 seconds.

Furthermore, another stimulus was involved. Remember the click the timer made? That warning stimulus always preceded the aversive tone by 3 seconds. If Sid maintained his erect posture continuously, he would not only avoid the aversive tone but, also, he would avoid the warning stimulus—the click.*

Before	Behavior	After
Sid will hear a click immediately.	Sid maintains an erect posture.	Sid won't hear a click immediately.

Definition: CONCEPT

Avoidance contingency

- Response-contingent
- **prevention** of
- a negative reinforcer
- resulting in an **increased** frequency of that response.

Operating behind this contingency is the ***avoidance principle***: *A response becomes more frequent in the future if it has prevented a negative reinforcer in the past*. (Note that the more immediate the negative reinforcer, the more effective is the avoidance contingency. In other words, the delay gradient applies to avoidance, just as it does to reinforcement. But it's a little trickier: In the case of avoidance, we're talking about the delay between when the response occurs and when the negative reinforcer would have occurred if the response had not been made. For example, if the negative reinforcer would have occurred within the next few seconds, preventing that negative reinforcer may greatly reinforce that response. However, if the negative reinforcer would not have occurred for nearly 60 seconds, preventing it will reinforce the avoidance response only slightly, if at all. And if the negative reinforcer would not have occurred for several minutes, preventing it will probably not reinforce the avoidance response at all.) (Also, note that avoidance contingencies are a type of reinforcement contingency. In other words, avoidance contingencies increase the frequency of the causal response. This is reinforcement by the prevention of the presentation of a negative reinforcer.)

Avoidance contingencies constantly keep us on our toes. I become especially aware of avoidance contingencies when I'm driving on one of those frantic eight-lane highways going into Chicago.

You drive perfectly and defensively or else it's wipeout city.

Before	Behavior	After
You will have an accident soon.	You drive perfectly and defensively.	You won't have an accident soon.

In fact, avoidance contingencies maintain the skilled locomotion of our bodies, as well as of our cars. Walking properly avoids the pain from stumbling, falling, and running into walls and doorways.

Before	Behavior	After
You will soon stumble and fall.	You walk perfectly.	You won't soon stumble and fall.

We may not appreciate the crucial role these aversive avoidance contingencies play in our lives, perhaps because we so easily avoid those mild negative reinforcers. The avoidance contingencies are so effective in shaping our behavior that by the time we're old enough to discuss them, we're so good at walking we don't even know they're there.

removed? And why isn't the removal of this avoidance contingency extinction?

* Heavy-Duty Discussion Topic: What's the role of mindfulness or self-awareness in this sort of intervention?

But that might not be true of the novice roller-skater. When you first learned to skate, you were painfully aware of those contingencies—thud! Have you ever hammered nails? Then surely you've come into contact with avoidance contingencies there as your thumb came into contact with your hammer—splat! What about cutting vegetables? Slice. And did you ever use a chain saw, not on vegetables but on logs? Zip.

QUESTIONS

1. *Avoidance contingency*—define it and diagram its use:
   - to improve posture
   - to maintain good driving
   - to maintain good walking
2. Diagram an avoidance contingency to reinforce erect posture.

Example

DEVELOPMENTAL DISABILITIES

Avoidance of a Negative Reinforcer (a Mildly Aversive Overcorrection)

Jimmy, the Child With Autism—Part XVI

Jimmy's Eyes[3]

In working with the autistic child Jimmy, Sue had used differential reinforcement of alternative behavior to reduce his disruptions (Chapter 11). For their practicum in Sid's behavior-analysis course, Joe and Eve also worked with Jimmy at Mae's school. They were doing this so Jimmy could have more help than Sue alone could provide. But they had made no progress. Mae, the behavior analyst, observed a training session; she then pointed out what might have been a problem.

"**When you're having trouble with a training program, you always ask this question: Does the student have the prerequisite skills?** Now it turns out that eye contact is a prerequisite for most instructional programs, and I notice that Jimmy looks everywhere but at you two. So you need to work on that first."

And work on it they did, 20 training trials a session, 10 sessions a day: "Look at me . . . Good!" Eve handed Jimmy a small piece of his favorite food, bologna. Eve, Joe, and Jimmy progressed a little, but not much. They got Jimmy making eye contact on 24% of the trials, but after 1,000 trials, they hadn't gotten any further with this refinement of the discrete trial procedure. Back to Mae.

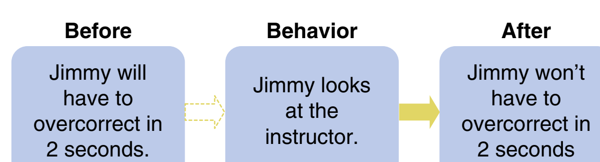
"OK, you've met the ethical standards of behavior analysis. You've tried to use reinforcers. Not only have you used a conditioned reinforcer—social approval—but you've also used an unconditioned reinforcer—Jimmy's favorite food, bologna," Mae said.[4]

"But that wasn't good enough," Eve said.

"Right, the guidelines for the client's rights to effective treatment indicate that Jimmy has a right to effective treatment, even if it involves negative reinforcement. So now you should try an avoidance contingency because it will probably be effective, and you've made a reasonable effort with positive reinforcement procedures," Mae said. "When Richard Foxx was at Anna State Hospital, he developed an avoidance procedure based on overcorrection."

"Oh, yes," Joe said, "overcorrection requires that the client overcorrects for any problem behavior. We read about this in Chapter 8, on punishment. When Ann trashed the hospital ward, she had to make it even better than it was. But how do we apply overcorrection to Jimmy?"

"Instead of a punishment contingency, you should use an avoidance contingency. Jimmy avoids the mildly aversive overcorrection procedure when he answers your request that he look at you," Mae said. "But if he doesn't look at you, then do what Foxx did. Stand behind Jimmy and tell him to look up, down, or straight ahead. If he doesn't, you use your hands to guide his head. He should hold each of the three positions for 15 seconds. Then go back to your eye contact training procedure." (Note that this is overcorrection, though it involves physical guidance.)



Eve and Joe used Fox's avoidance procedure and got immediate results: On the first day of the avoidance procedure, Jimmy went from 24% eye contact to 74%. By the tenth day, he was around 97% (Figure 17.2). Now that Jimmy was "attending" to them, Eve and Joe were ready to get down to some serious language training.

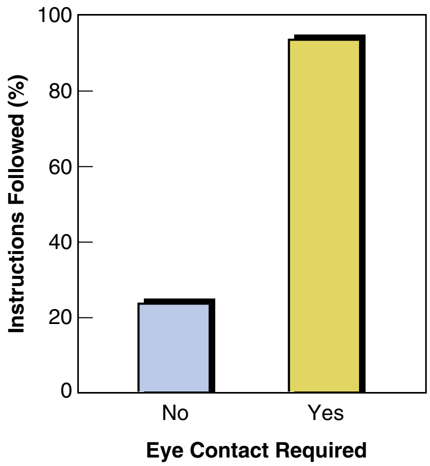


Figure 17.2 Avoidance of Overcorrection Improves Eye Contact, Which Improves Following Instructions

QUESTIONS

1. Diagram a behavioral contingency used to get eye contact with an autistic child.
2. What kind of contingency is it?

   a. Avoidance of a negative reinforcer
   b. Avoidance of the loss of a reinforcer
   c. Negative reinforcement
   d. Punishment

(To be confident of your answer to such questions, always check the title of the chapter and section.)

EYE CONTACT[5]

Sid's Seminar

Tom: I've got a problem with "Jimmy's Eyes." I don't think eye contact is really needed for attention. I can attend to people without even looking at them, let alone making eye contact.

Max: And I might make eye contact without really attending to what the other person is saying or doing.

Eve: In some cultures, it's a sign of disrespect to make eye contact with the speaker, so people avoid making eye contact.

Sid: I agree; you're all making good points. But suppose you're having trouble bringing someone's behavior under the stimulus control of what you're saying. To put it loosely, suppose you're having trouble getting someone to listen to you. Maybe the person is watching the tube. Wouldn't you think it more likely that what you said would affect the person's behavior if you turned off the tube and waited until he or she looked at you before you started talking?

Joe: Yeah, I don't think the book was talking about a biological or cultural universal—just a rough general rule.

Max: Yes, here it is: **Eye contact general rule**: If you're having trouble getting a person to listen to you, be sure you have eye contact before you start talking.

Sid: Yes, eye contact may be neither necessary nor sufficient to get someone to follow your instructions. But it helps, especially when you're working with clients with autism and developmental disabilities and with schoolchildren having academic problems. Carolynn Hamlet, Saul Axelrod, and Steven Kuerschner collected some excellent data supporting that general rule.

QUESTION

1. According to the book, if someone (e.g., a student with autism) isn't listening to you, what might you do to get his or her behavior under the control of your verbal instructions?

Concept

AVOIDANCE-OF-LOSS CONTINGENCY

Sid's Satiny Satanic Sins

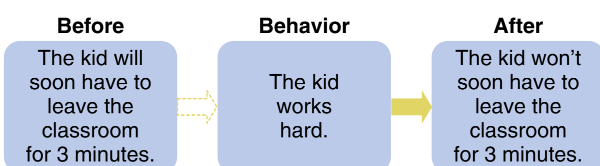
It was July 4th. The noon sun was sizzling—102° Fahrenheit. No traffic. A perfect time for Sid to go for a bike ride. He rode past the local Dangerous Dairy Delights, with its high-cholesterol, high-fat, high-sugar temptations. He was proud of himself for passing up those satiny satanic sins. But on his way back after an hour's hot riding, he couldn't resist. He bought a triple-dipper cone—one dip red raspberry, one white vanilla, and one blueberry—the patriotic July 4th special. He found himself riding home, steering his bike with one hand and trying to balance the monstrous cone with the other, doing his best not to lose the precarious top scoop and licking as fast as he could to get to his ice cream before the sun did.

Sid was balancing and licking as he'd never done before, because avoidance of the loss of a reinforcer (the ice cream) was contingent on this behavior.

The Terrible Trio Meets the Avoidance of Time-Out

Once upon a time, there were three completely off-the-wall kids in the seventh-grade class of Mae's school. The classroom teacher was using a token economy, but that didn't cut it with the terrible trio. So she added a time-out procedure. She used time-out because life in the classroom seemed to be a reinforcer for these kids: They were rarely late for class and almost never missed a day (though the teacher wished they would miss a few).

At first, Mae was going to suggest that the teacher use a traditional punishment procedure based on the time-out. But after looking at the baseline data of the kids' disruptions as part of a functional analysis, she decided not to. These kids came up with so many different ways to disrupt the class that she couldn't specify any limited set of responses to punish with the time-out. So she decided to use an avoidance contingency. Each member of the trio could avoid time-out from the classroom by being on task—by working hard. The teacher would set a kitchen timer to go off every few minutes, after variable periods of time. If a kid was working hard when the bell rang, he got to stay in the classroom. If a kid was staring out of the window, whispering, sleeping, hopping out of his seat without permission, clowning, throwing spitballs—anything but working—it was into the hall for 3 minutes. But you can bet she wouldn't put them in the hall as a team; it was strictly one-on-one. This is another example of reinforcement by the avoidance of the loss of a reinforcer.



Incidentally, only the teacher could see the timer. The kids had no clue, so they couldn't keep one eye on the timer, goof off until right before the bell would ring, and then start working hard (the response that would avoid the time-out). Neither Mae nor the teacher was that dumb.*

Definition: CONCEPT

Avoidance-of-loss contingency

- Response-contingent
- **prevention of loss**
- of a reinforcer
- resulting in an **increased** frequency of that response.

* The bell was only a prompt for the teacher and was not part of the kids' contingency.

Operating beneath this contingency is the ***principle of avoidance of loss***—a response becomes more frequent in the future if it has prevented the loss of a reinforcer in the past.

Again, note that this is also a type of reinforcement contingency, because it increases the frequency of the causal response. It is reinforcement by avoidance of the loss of a reinforcer.

QUESTION

1. *Avoidance-of-loss contingency*—define it and diagram some examples.

Example

BEHAVIORAL SCHOOL PSYCHOLOGY

Avoidance of Reprimands[6]

It was summertime in Centereach, New York. Eight first-, second-, and third-grade students were attending remedial summer school because they had blown it in reading or math during the regular school year. Six of them also had behavior problems. The challenge was to keep them on task long enough that they could get some schoolwork done and to keep them from shouting out, hopping out of their seats, daydreaming, fighting—you name it.

The teacher started out using nothing but reinforcement for being on task—praise, bonus work, and public posting of assignments. Better than nothing, no doubt, but not good enough. Then the teacher added more reinforcers—stars, work breaks, puzzles, coloring, reading comic books, running errands, and a host of other super-reinforcers. A little more on task, but not much.

Finally, the teacher looked at the other side of the coin. Besides reinforcing on-task behavior with the presentations of reinforcers, why not add another contingency—one based on negative reinforcers? The negative reinforcers were brief, specific reprimands—"Joyce, get back in your seat and get to work." "Joyce, don't just sit there, get back to work."

Now here's the question: What's this aversive-control contingency?

a. Punishment of goofing off by presenting reprimands
b. Avoidance of reprimands

Well, in the 2nd edition of this book, we had this example in the punishment chapter. And one of our university students said we were wrong and that the following contingency was wrong.

The Wrong Contingency Diagram

Before	Behavior	After
Joyce receives no reprimand.	Joyce goofs off.	Joyce receives a reprimand.

She said *goofs off* is too large a response class—it also includes doing nothing, and doing nothing isn't behavior. *Doing nothing* fails the dead-man test. Dead men can do nothing. Well, what do you do when the dead man raises his ugly head from the grave? We roll him over. If we thought we had some sort of reinforcement contingency, we really have some sort of punishment contingency. And if we thought we had some sort of punishment contingency, we've really got some sort of reinforcement contingency—probably avoidance. That means, instead of punishing goofing off (being off-task), we're reinforcing studying. And, as in this case, that reinforcement will usually be in the form of an avoidance contingency.

How can Joyce avoid reprimands? By studying.

The Right Contingency Diagram

Before	Behavior	After
Joyce will receive a reprimand soon.	Joyce studies.	Joyce won't receive a reprimand soon.

At last, the combination of the two types of contingencies did the trick—reinforcement for on-task behavior and avoidance of brief reprimands (another form of reinforcement, really). The students finally got down to business. And their hard work produced academic payoffs, too. The accuracy of their work improved from about 59% during the reinforcement conditions to 80% when the teacher added the avoidance contingency (Figure 17.3).

QUESTION

1. Describe the use of an avoidance contingency to ensure a student stays on task. Diagram and label the relevant contingency.

Compare and Contrast

NEGATIVE REINFORCEMENT VS. AVOIDANCE

Let's look at two contingencies involving negative reinforcers—***avoidance (prevention) of a negative reinforcer***

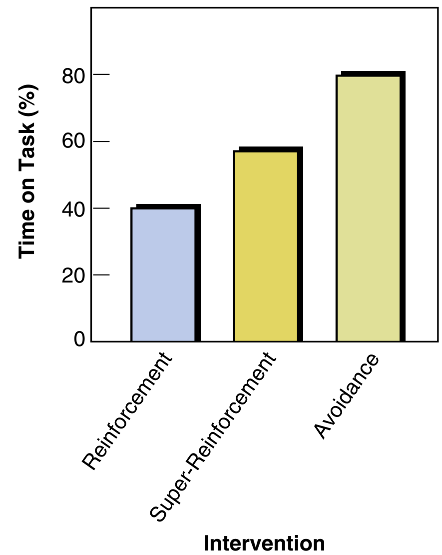


Figure 17.3 Avoidance of Reprimands for Goofing Off in Class

and ***removal of a negative reinforcer*** (our old friend the negative reinforcement contingency).

With ***avoidance***, the response prevents a negative reinforcer from being received. For example, with Foxx's procedure, Jimmy avoided a mildly aversive overcorrection procedure whenever he looked at Eve or Joe during their instruction program. This greatly increased Jimmy's looking at these two instructors when that avoidance contingency was in effect.

With ***negative reinforcement***, the response causes a negative reinforcer to be removed. For example, suppose Eve and Joe played a mildly aversive tone each time they asked Jimmy to look at them. And suppose Jimmy could escape the tone by looking at them. This might greatly increase eye contact when that negative reinforcement contingency was in effect.

In short, the two contingencies are similar—avoidance prevents a negative reinforcer from being presented, and negative reinforcement removes a negative reinforcer that has already been presented.*

* And now another little apologetic attempt at terminology clarification: Behavior analysts classify escape from a negative reinforcer as *negative reinforcement*; they also classify avoidance of a negative reinforcer as *negative reinforcement*. So there are two types of negative reinforcement: *escape from a negative reinforcer* and *avoidance of a negative reinforcer*. But don't sweat it; you can generally just stick with *escape* and *avoidance*.

QUESTION

1. Compare and contrast negative reinforcement vs. avoidance.

CROSS-CULTURAL CONFLICT

Way back in the day, I was trained to seat my little sis, Peggy Jo, at the dinner table, not only for Sunday dinners out at a fancy restaurant but also at home and for all everyday meals. And on the rare occasion when it arose, for any other female I'd be dining next to. If I failed to do so, I wouldn't be a little gentleman. And my not being a little gentleman would disappoint Mommy and Daddy—a negative reinforcer for me. So, to avoid that negative reinforcer, I'd pull out Peggy's chair and graciously seat her.

And because not being a little gentleman was paired with the disapproving disappointment of Mommy and Daddy, I've scrupulously dinner-table seated every woman in sight for decades since, including my domestic partner Motoko, for our first 10 years. (Amazingly, I'm mildly uncomfortable when I fail to seat a nearby woman, even though it's been 70 years since the original pairing with parental disapproval!)

However, one day, Motoko informed me that she found my seating her slightly irritating, in other words, a negative reinforcer! This punished and immediately suppressed that specific little-gentleman behavior with Motoko—cross-cultural conflict. (The implicit, don't-seat-Motoko rule-governed-analog-to-punishment did it; she now seats herself independently of my gentlemanly but heavy hand.)

And there's more: Somewhat further back in the day, I spent a fair amount of time with Naoko Sugiyama and her husband Masaya Sato. At that time, Naoko and I ran into a serious cross-cultural conflict. I felt uncomfortable not holding the door open for her and she felt uncomfortable not holding the door open for me, because I knew that's what a little gentleman should do and she knew that's what a little lady should do. And we were both trying hard to avoid the negatively reinforcing feeling of not being gentlemanly or ladylike. Cleverly, we came up with a rule-governed solution to the conflict: I'd hold the door open for her in America, and she'd hold the door open for me in Japan.

What really impresses me about this is how a little childhood avoidance contingency can control our behavior for the rest of our lives. Not only that, but the negative reinforcer in the contingency was just a conditioned negative reinforcer, very mild Mommy-Daddy disapproval, never anything like an unconditioned, physical negative reinforcer. The other thing I find interesting is how a rule-governed analog can immediately remove the aversiveness of being ungentlemanly—immediately I was cool with not seating Motoko and not opening the door for Naoko. So now I have discriminated avoidance contingencies: Motoko is an S^{Δ} for the gentlemanly seating contingency, and Naoko is an S^{Δ} for the gentlemanly door-opening contingency.*

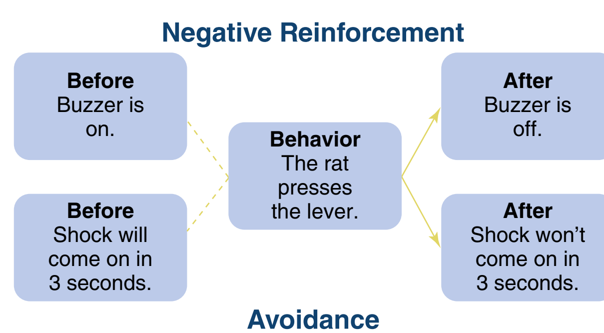
In the Skinner Box

AVOIDANCE OF A NEGATIVE REINFORCER

These prevention contingencies are tricky, to say the least. To clarify them a bit, let's look at the simplest cases—in the Skinner box. The following four sections deal with four types of avoidance.

Cued Avoidance

A buzzer (warning stimulus) comes on, and 3 seconds later, a mild, but aversive, shock comes on for a few seconds. Then both the buzzer and the shock go off. However, suppose the rat presses the lever within the 3 seconds after the buzzer (warning stimulus) comes on. Then the buzzer will go off, and the rat will have avoided the shock (the shock won't come on). Or suppose the rat waits until the shock comes on and then presses the bar. Then both the shock and the buzzer will go off.



* After reading this section, Motoko explained to me that she preferred to seat herself, just because she's an independent woman, not because of her Japanese heritage. And I just realized, I should probably check with Motoko to see how she really feels about my door opening; maybe her not complaining is being suppressed by the early-childhood, don't-be-ungrateful, punishment contingency.

After some training (exposure to these contingencies), the shock negative reinforcement contingency controls the behavior. As soon as the shock comes on, the rat presses the lever.

And what happens after even more exposure to the contingencies? The rat starts pressing the lever during the 3 seconds the buzzer is on by itself. When the rat responds during the buzzer, it not only turns off the buzzer but also avoids the shock. We call the buzzer the *warning stimulus* because it occurs before the negative reinforcer. But, at the beginning, the buzzer is a *neutral* stimulus—neutral in the sense that it is neither a positive reinforcer nor a negative reinforcer. However, after repeated pairing with the original negative reinforcer, the buzzer stops being neutral and also becomes a negative reinforcer.

So another way to look at it is that the cued avoidance procedure is really just a tricky way to implement our old buddy the **pairing procedure**—*pairing of a neutral stimulus with a positive reinforcer or negative reinforcer*. And the pairing procedure brings into play another old buddy, the **value-altering principle**—*the pairing procedure converts a neutral stimulus into a conditioned reinforcer or conditioned negative reinforcer.**

Neutral Stimulus	Negative Reinforcer
Buzzer	Shock
No buzzer	No shock

By the way, the negative reinforcement/avoidance contingency is called ***cued*** *avoidance* because of the warning stimulus (e.g., the buzzer), which is supposed to be the cue. However, as we will see later, this is misleading terminology.

Continuous-Response Avoidance

But it didn't work that way for Sid. He also could avoid the click of the timer, as well as the aversive tone. How could he do that? By continuously maintaining good posture.

Before	Behavior	After
Sid will hear a click immediately.	Sid maintains an erect posture.	Sid won't hear a click immediately.

* Some of us think that it is only the negative reinforcement contingency that directly controls the behavior. The avoidance contingency simply serves to ensure that the buzzer has had a sufficient history of pairing to become aversive enough that its termination will reinforce the escape response.

How could we take it to the Skinner box? How could we set up the contingencies for a continuous-avoidance response for Rudolph? Well, we might set it up so that as long as Rudolph holds down the lever, he will prevent the buzzer from sounding.

Before	Behavior	After
Rudolph will hear the buzzer.	Rudolph holds down the lever.	Rudolph will not hear the buzzer.

Now Sid avoided not only the aversive tone but also the preliminary click by maintaining that posture.

Before	Behavior	After
Sid will hear a click immediately *and* the loud tone in 3 seconds.	Sid maintains an erect posture.	Sid won't hear a click immediately *or* the loud tone in 3 seconds.

It wasn't enough to stand erect briefly and then fall back into his familiar old slouch. Sid had to make a continuous response that avoided the click as long as he kept making that response (i.e., as long as he kept an erect posture).

And we could arrange combination-package contingencies like this to make them analogous to Sid's: Rudolph could avoid the preliminary buzzer as long as he would hold the lever down, but also he would avoid the shock that would otherwise be coming in 3 seconds.

Before	Behavior	After
Rudolph will hear the buzzer *and* in 3 seconds he will receive a brief shock.	Rudolph keeps the lever pressed down.	Rudolph won't hear the buzzer *nor* in 3 seconds will he receive a brief shock.

Note that it isn't essential that continuous-response avoidance involve a package deal like the combination of click and tone or buzzer and shock. Sid's avoiding the click and Rudolph's avoiding the buzzer were also examples of continuous-response avoidance.**

** And to drill down a little further than most would care to go, Sid also has an escape contingency: He just heard the click, and the next three seconds after having heard the click and continuing in the slouching position is paired with the aversive buzzer. So just hearing the click and continuing to slouch, itself, becomes a conditioned negative reinforcer. And Sid can escape that conditioned negative reinforcer by straightening up.

Non-Cued Avoidance

Another variation on the avoidance theme is non-cued avoidance. If the rat just sits there and does nothing, a brief shock will come on every 20 seconds (shock–shock interval of 20 seconds), with no warning stimulus. But if the rat presses the bar, it will postpone the shock for 20 seconds (response–shock interval of 20 seconds). So if the rat presses the lever every 19.99999 seconds, it will never get a shock. We could change the contingencies slightly by making the response–shock interval 30 seconds. Then, if the rat presses the lever every 29.99999 seconds, it will never get a shock.

Before	Behavior	After
The shock will come on in 20 seconds	The rat presses the lever.	The shock will not come on in 20 seconds.

Considerable work has been done using this avoidance procedure with monkeys. They soon develop a moderate rate of steady responding that prevents almost all the shocks.

This contingency is ***non-cued avoidance*** because there is no obvious so-called warning stimulus (e.g., no buzzer).

Avoidance of the Loss of a Reinforcer

We don't know of any actual Skinner box experiments on the avoidance of the loss of a reinforcer, but here's an obvious example: A water-deprived Rudolph the Rat is drinking from a dish of water. And pest that you are, you remove the dish every 20 seconds and keep it out of the Skinner box for 10 seconds. But if Rudolph pulls a chain, you will not pester him for 20 seconds—non-cued avoidance of the loss of a reinforcer. If Rudolph pulls the chain every 19.99999 seconds, he will completely avoid the loss of the water.

Non-Cued Avoidance of the Loss of a Reinforcer

Before	Behavior	After
Rudolph will lose the water in 20 seconds.	Rudolph pulls the chain.	Rudolph won't lose the water in 20 seconds.

As we said, we know of no one who's actually done this experiment. It might make a fun research project at the BA, MA, or even PhD level. What do you think? Would it work? If you do it, let us know.

It's easy to confuse avoidance of the loss of a reinforcer with a negative punishment contingency. Don't. Here's what a comparable negative punishment contingency would look like:

Negative Punishment

Before	Behavior	After
Rudolph has the dish of water.	Rudolph presses the lever.	Rudolph loses the dish of water for 10 seconds.

In other words, in a negative punishment contingency, the reinforcer is removed if a specific response occurs. But in this avoidance contingency, the reinforcer is removed if a specific response doesn't occur. In the case of avoidance, the removal is *not* contingent on the response.

QUESTIONS

1. Diagram cued avoidance in the Skinner box.
2. Diagram either example of the continuous-response avoidance used to maintain erect posture.
3. Diagram either example of continuous-response avoidance in the Skinner box.
4. Diagram non-cued avoidance in the Skinner box.
5. Diagram the avoidance of the loss of a reinforcer in the Skinner box.
6. In avoidance of the loss of a reinforcer, is removal contingent on a specific response? Explain your answer.
7. Now this one's not very straightforward, but what was the terrible trio's avoidance of time-out?
   a. cued avoidance of the loss of a reinforcer
   b. non-cued avoidance of the loss of a reinforcer
   c. continuous avoidance of the loss of reinforcer

AVOIDANCE IN YOUR EVERYDAY LIFE

Your life would be a complete mess if it weren't for avoidance contingencies. Like, if it weren't for avoidance contingencies, you might even have met a premature death by now and wouldn't have the opportunity to read this nice section about how grateful you should be to avoidance contingencies. Like for real, Dude, the last time you drove to the Hard Rock Café, you'd have wiped out on the highway before you got there, if it weren't for avoidance contingencies. So, as your car began, ever so slightly, to head off the road, you saw that slight creep toward the shoulder, and that sight was a negative reinforcer, but a stimulus so subtle that you weren't even aware of it. Nonetheless, you escaped that negative reinforcer by slightly turning your steering wheel in the other direction, an escape response that was so subtle you weren't even aware of it either. And the result is that you avoided becoming an accident statistic, at least on that trip.

You're sitting at your dinner table reading this section and marking it up with your highlighter. You lay your highlighter on the table, as you pause to contemplate the profundity of the preceding paragraph and to think of other avoidance examples from your everyday life. But out of the corner of your eye, you see your magic marker starting to roll off the table. Not a major tragedy in the making, but nonetheless, the sight is a mild negative reinforcer, which you escape by quickly grabbing your highlighter and standing it on its end, thereby avoiding its rolling onto the floor.

Of course, your reading this very chapter avoids a poor grade on your next quiz, but that's a much more complex, language-based form of avoidance that we'll read about in Chapters 25 and 26.

QUESTION

1. How about an everyday example of the benefits of avoidance contingencies.

Compare and Contrast

AVOIDANCE OF A NEGATIVE REINFORCER VS. PUNISHMENT BY THE PRESENTATION OF A NEGATIVE REINFORCER

There's a fine line between reinforcement based on ***avoidance*** of a negative reinforcer and punishment based on the ***presentation*** of a negative reinforcer. But it may be worth trying to draw that line, so sharpen your pencils.

What we consider to be the crucial response determines how we look at the contingencies. Consider Sid's perfect-posture contingency. Suppose we think of the response to be slouching. Then the click and tone may punish that response, and we have a punishment contingency (Azrin and his colleagues looked at it that way). Earlier, we considered the perfect posture to be the response. Then we have an avoidance contingency—the perfect posture avoids a negative reinforcer.

Are these two different ways of saying the same thing—punishment of poor posture vs. reinforcement of good posture using an avoidance contingency? Or can we distinguish between two different contingencies? Here's our tentative answer. They're two different deals. Why?

Before we answer that question, let's review an old favorite—the *dead-man test: If a dead man can do it, it ain't behavior.*

Dead men slouch. They don't have good posture—at least not before rigor mortis sets in. So slouching doesn't pass the dead-man test.

Here's a less gruesome analysis: Sid slouches when he makes no effort, when he doesn't do anything. So slouching is a nothing, non-behavior. And what do we do when our proposed behavior fails the dead-man test? *Roll over the dead man.* Use the opposite response. What's the opposite of slouching? Having a good posture. And when we roll over the dead man who we thought had a punishment contingency, we always seem to end up with an avoidance contingency. So maintaining a good posture is effortful for Sid. It's a response that avoids the click of the timer.

In sum, if we have to roll over the dead man from a punishment contingency, we always seem to end up with a live man involved in an avoidance contingency. This is so confusing; maybe we should look at another example.

The Amazing Adventures of Behaviorman (Behaviorwoman)

You and your favorite girlfriend, boyfriend, or spouse are visiting Disney World (Disneyland, for those of you on the West Coast). You've just entered the Haunted Mansion and stepped into the incredible shrinking room. Look up there! What's happening? The ceiling's lowering. It's coming in on us. It's as if you're standing at the bottom of an elevator shaft and the elevator is slowly descending to the basement level. Great fun. It'll stop any minute now, and you'll all have a good laugh.

But the ceiling doesn't stop. It keeps descending. First, it's squashing down on the heads of the tallest people. Then all but the shortest kids are bending down. This is carrying a joke too far. People shout, scream, and pound on the walls. But the ceiling keeps approaching the floor. Only you stand between your girlfriend, boyfriend, or spouse, a dozen other innocent tourists and the most grisly death imaginable—squashed like bugs in a fun house.

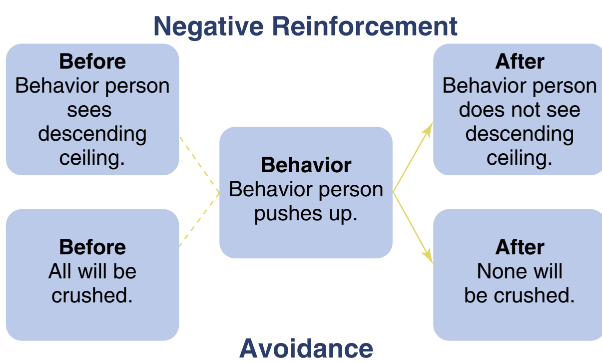
You inconspicuously whip off your outer clothes to reveal a set of striking blue leotards with red initials on a yellow field—*BM*, for Behaviorman (or *BW*, for Behaviorwoman). You get down on one knee, raise your hands above your head (palms up), and push against the ceiling with all your behavioral might. You strain, your muscles ripple, you grunt, you sweat (perspire if you're from the East Coast). Can you stop this ceiling? Can you save these innocent people from one of the most embarrassing deaths known to humankind?

And what does your arch foe, the Mad Mentalist, have to do with this?

But first, a word from our sponsor, *Principles of Behavior*. Ask yourself, as you grunt and strain to hold up the ceiling:

> Am I making an active response?
> You bet your blue leotards you are.
> Is holding up the ceiling the response of interest? It'd better be.
> Am I avoiding certain death?
> Trying.
> Is this an avoidance contingency?

Yes, actually cued avoidance, which means a combination of negative reinforcement and avoidance.



Would doing nothing, just relaxing, be punished? Yes, the dead-man test would take on new significance.

Careful . . . the ceiling just came down another half inch.

I mean no. No, you can't punish a nothing, a nonresponse.

Good, you just pushed the ceiling up 4 inches.

Punishing a nonresponse (not pushing up on the ceiling) fails the dead-man test. So we roll over the dead man, selecting the opposite of *not pushing*, which is *pushing*, and selecting sort of the opposite of *punishment*, which is *avoidance*.

You see boys and girls, BM (BW) is making an avoidance response. In fact, he (she) must keep passing the dead-man test, or else. Or else what? You guess.

The dead-man test is one way to discriminate between avoidance and punishment. Here's a second way that sometimes helps: *Is the so-called* ***punished*** *response really a large class, consisting of all other imaginable responses? If yes, then we've got an avoidance contingency and not a punishment contingency*.

Consider your role as Behaviorperson. Instead of holding up the ceiling, you could pick your nose, scratch your rear end, crack jokes, or take a nap. It doesn't seem too useful to talk about punishing an infinitely large response class. Instead, we should talk about an avoidance contingency that reinforces the smaller response class of holding up the ceiling.

Be sure to tune in next time when Behaviorperson asks: Can we have a contingency based on avoidance of the loss of a reinforcer, or will we get tongue-tied trying to work it out?

QUESTION

1. With a concrete example, compare and contrast avoidance of a negative reinforcer and punishment by the presentation of a negative reinforcer.
   - Use the dead-man test.
   - Is the so-called punished response class so infinitely large that it's not useful to think of it as a punishable response class? Explain.

Compare and Contrast

DIFFERENTIAL PUNISHMENT VS. DIFFERENTIAL AVOIDANCE

In Chapter 11 we looked at a few examples of differential punishment: punishing the response classes of incorrect ballet moves and unladylike behavior. In each case, the punished response classes decreased in frequency, but also the unpunished response classes increased in frequency—correct ballet moves and ladylike behavior. In both cases, there were no other options, you either made the incorrect moves or you made the correct moves; you either didn't act like a lady or you did.

Because there were no options, we can also consider the differential contingencies to be avoidance contingencies: The correct moves and acting like a lady avoided negative reinforcers—the deep freeze and the forced march up and down the stairs. So when there are no options, the contingencies of differential punishment and differential avoidance are identical.

Compare and Contrast

AVOIDANCE OF LOSS OF A REINFORCER VS. PUNISHMENT BY REMOVAL OF A REINFORCER

We've compared reinforcement based on avoidance of the presentation of a negative reinforcer with punishment by the presentation of a negative reinforcer (punisher)—a bit tricky. Well, you ain't seen nothin' yet. Now we're going to compare reinforcement based on ***avoidance of the removal*** of a reinforcer with our old buddy, punishment by the ***removal*** of a reinforcer (the negative punishment contingency).

Let's look again at Mae's work with the terrible trio. She used avoidance of the loss of a reinforcer. Being on task avoided time-out; it avoided the loss of the reinforcer of being in the classroom.

OK, but could we look at Mae's procedure as punishment by the removal of a reinforcer? What response are we punishing? Not being on task? Dead man! Remember, things get murky when we talk about reinforcing and punishing non-behavior such as not studying, not being on task. People who keep their eye on the hole and not on the doughnut go hungry.

OK, could we say Mae was punishing throwing spitballs, getting out of the seat, and causing a ruckus? We could, but probably we'd be wrong. Mae didn't put a contingency on throwing spitballs. If she had, it might be something like this: As soon as one of the trio threw a spitball, the offender would be put in time-out. Now we're talkin' negative punishment contingency.

But the contingency didn't work that way. With Mae's avoidance contingency, the kid might have thrown a dozen spitballs and still not have had to go into time-out. Why not? Because he might have bombarded his buddies and then gotten back to work before the teacher's bell rang, so he would be on task and would thus avoid time-out.

Besides, Mae specified the response that would avoid time-out. She didn't specify the responses that would receive punishment.

Avoidance of the Loss of a Reinforcer vs. Punishment by the Removal of a Reinforcer

	Avoidance of the Loss of a Reinforcer	Punishment by the Removal of a Reinforcer (Negative Punishment)
Involves the removal of a reinforcer.*	Yes	Yes
Removal of the reinforcer is contingent on a specific response.	No	Yes
Keeping the reinforcer is contingent on a specific response.	Yes	No
The frequency of the response of interest.	Increases	Decreases

* To be more precise, we might say *involves the removal of a reinforcer or the potential for the removal of a reinforcer*. Here's why: Suppose the person always made the avoidance response; then there'd be no actual removal of a reinforcer, but always the potential for its removal if the person ever did fail to respond. Or suppose the person never made the punished response; then, again, there'd be no actual removal of a reinforcer, but always the potential for its removal if the person ever did respond.

QUESTION

1. Using two concrete examples (e.g., the on-task contingency and the spitball contingency), compare and contrast avoidance of the loss of a reinforcer and punishment by the removal of a reinforcer.
   - Show how each contingency fits the appropriate cells in the preceding table.
   - Use the dead-man test.
   - Is the non-avoidance response class so infinitely large that it's not useful to think of it as a punishable response class? Explain.

Compare and Contrast

WARNING STIMULUS VS. DISCRIMINATIVE STIMULUS

We've been using the term *warning stimulus* throughout this chapter, so now let's explain it. We've held off until this point because the context should have made our use clear earlier.

Definition: CONCEPT

Warning stimulus

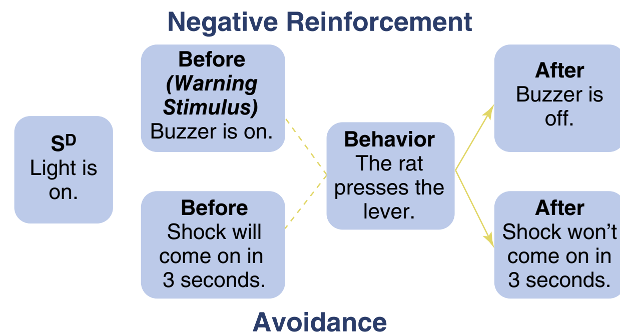
- A stimulus that precedes
- a negative reinforcer
- and therefore becomes a conditioned negative reinforcer.

We use **warning stimulus** when discussing cued avoidance. Remember: A buzzer goes on, and 3 seconds later a shock comes on for a few seconds. If the rat presses the lever within the 3 seconds after the buzzer comes on, the buzzer will go off, and the rat will have avoided the shock (the shock won't come on). The buzzer is the stimulus that occurs preliminary to the presentation of the shock.

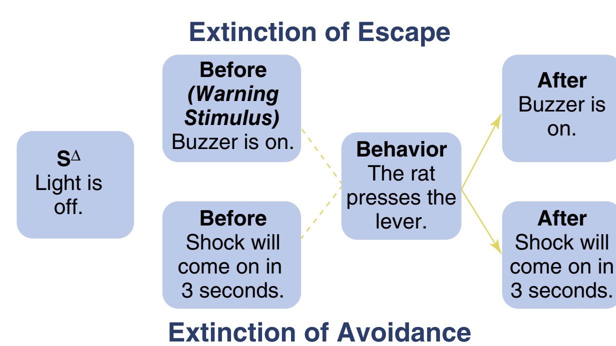
Now, traditionally, behavior analysts have analyzed this contingency as if the warning stimulus were a discriminative stimulus. But I think that's not the way to look at it. So, first let's review the definition of **discriminative stimulus**—*a stimulus in the presence of which a response will be reinforced*. What does that mean for cued avoidance? Well, the traditional view is that the warning stimulus (the buzzer) is the stimulus in the presence of which the response (the lever press) will be reinforced (by the termination of the buzzer or the avoidance of the shock).

However, we think it's better to *look at the presence of the warning stimulus as the before condition—the motivating condition*. In other words, to say the warning stimulus is the stimulus in the presence of which the lever press will be reinforced is like saying no food is the stimulus in the presence of which the food-getting response will be reinforced. You must have the absence of food as a motivating condition before getting food is reinforcing. And a little closer to home. Suppose we're doing escape from shock in the Skinner box. The shock is the before condition, the motivating operation, not the S^D. The shock must be on before the rat will be "motivated" to press the lever. Or suppose we paired a buzzer with the shock, so that the buzzer became a negative reinforcer. Then we could do escape from the aversive buzzer in the Skinner box. And now the buzzer is the before condition, motivating operation, not the S^D. So how would we set up an S^D for the buzzer-escape contingency? Add a light as the S^D. When the light is on, pressing the lever will escape the buzzer; when the light is off, pressing the lever won't escape the buzzer. The light, not the buzzer, is the S^D, and the same is true if we want to have an S^D with a cued-avoidance contingency.

Now take a deep breath and check out the following diagram. Don't panic; just take a couple of minutes to figure out what's going on. It has a lot of logic to it; it makes sense. Once you understand it, you should have no trouble drawing it on your own, without actually memorizing all the details. The logic says it has to be more or less like this.*



Note that the following S^Δ contingencies are extinction contingencies. And note that we are extinguishing the lever press response with regards to both the negative reinforcement and the avoidance contingencies, but we could have extinguished with regard to either one and kept the other one in effect.



Still feeling confused? I don't blame you; it's hard. But if you'd like to get straight, please go to DickMalott.com and check out the homework for this chapter.

QUESTIONS

1. *Warning stimulus*—define it and give an example.
2. Diagram a contingency for cued avoidance with an S^D and S^Δ.

* The traditional terminology *warning stimulus* and *cue* seem to reflect early confusion in our field by suggesting that the original researchers in avoidance also made the common error of mistaking the before condition for the S^D. And this terminology just makes it all the more difficult for current students to keep it straight. Sorry about that.

3. Describe a negative reinforcement/avoidance contingency that involves a discriminative stimulus, and explain the difference between the warning stimulus and the discriminative stimulus in that contingency.
4. Where does the warning stimulus go in the contingency diagram?

Research Methods

USING PILOT STUDIES TO HELP YOU

Get Your Act Together Before You Take It on the Road

The avoidance procedure for helping Sid maintain a good posture seemed good in theory, but Dawn and Sid ran into the same problems Azrin's team had met, and they used the same solutions. The problems all involved false alarms—the aversive tone would sound even when Sid was still maintaining a good posture. When Sid looked over his shoulder, his back rounded for that brief time and activated the tone generator. So they added a 3-second timer to the apparatus. This provided a 3-second free period, during which Sid would not have to maintain his posture or his straight back.

When Sid reached, his shoulder blades moved and activated the timer. So they placed the straps above his shoulder blades. When he bent forward, this also activated the timer. So they added a tilt switch that prevented the timer from starting when he leaned forward by more than 10 degrees. Now they were ready for business, but only after they had worked hard to improve their original intervention. This illustrates the ***great new-ideas general rule:*** *New ideas rarely work until you've revised them at least three times*.

And this brief diversion into the development of effective procedures suggests two additional general rules:

- Allow time to recycle (do a pilot study) on any new idea before you actually have to implement it.
- When your great new idea doesn't work the first time, or the second time, or the third time, don't give up.

QUESTION

1. *The general rule for great new ideas*—give an example.

CUED AVOIDANCE AND CONDITIONAL NEGATIVE REINFORCERS

Jimmy's Eyes

Early in this chapter, we looked at the use of an avoidance contingency to help Jimmy get eye contact with his instructor. At that point, we just diagrammed the avoidance contingency. But because the avoidance contingency was in effect only after the instructor said, "Look at me," we really have a cued-avoidance contingency. But the question is, *What's the warning stimulus?* In other words, *What's the before condition for the negative reinforcement contingency?*

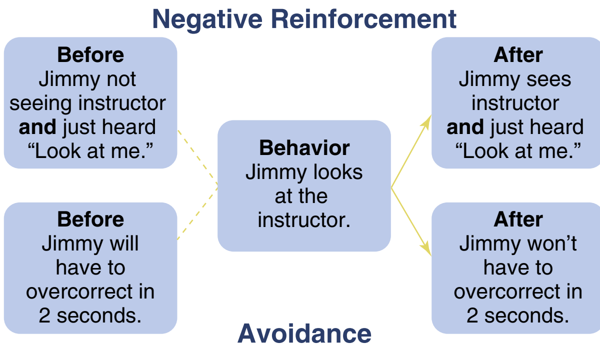
Our first answer might be to say, "*Look at me*" *is the before condition*, because Jimmy will be going into overcorrection in 2 seconds after he hears, "Look at me."

Well, that's part of the story, but not the whole story. The problem is that *Look at me* isn't quite like the *buzzer on* in the classic Skinner box negative reinforcement avoidance. The crucial difference is that the buzzer stays on until the rat escapes it by pressing the lever or until the shock is delivered. But the instructor does *not* say *Look at meeeeeeeeeeeeeeeee* until Jimmy looks or until 2 seconds have elapsed and he's gone into overcorrection. Instead the instructor briefly says, *Look at me*, and then Jimmy has 2 seconds of silence before overcorrection. But now, even if Jimmy immediately looks at the instructor, he doesn't escape having just heard *Look at me*. So what does Jimmy actually escape the instant he looks at the instructor?

This is tricky: I think he escapes a combination of stimuli. I think he escapes the stimuli arising from not looking at the instructor combined with *Look at me* having just been said. Jimmy's not seeing the instructor's face combined with just having heard *Look at me* is a compound or conditional stimulus that is paired with overcorrection. So we might say Jimmy's not seeing the instructor becomes a conditioned negative reinforcer, conditional upon having just heard *Look at me*. Only the combination of the two sets of stimuli is paired with overcorrection; neither set by itself gets paired with overcorrection. For example, *Look at me* immediately followed by the sight of the instructor's face isn't paired with overcorrection.

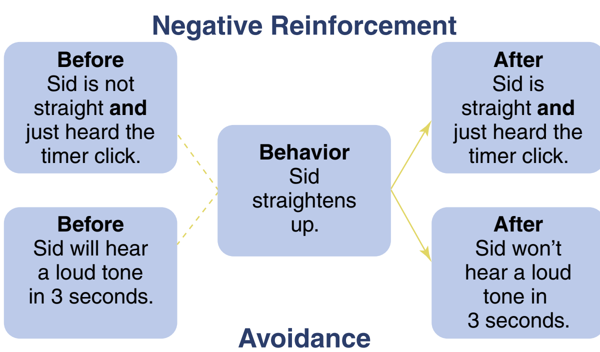
So what we have is a **conditional stimulus**: *Elements of a stimulus have their value or function only when they are combined; otherwise, the individual elements are relatively neutral.* In this case the conditional stimulus we have is a ***conditional (combined) negative reinforcer***; the absence of the sight of the instructor's face is a negative reinforcer, conditional upon (combined with) the instructor's having just said, "Look at me."

We said it was tricky.



Sidney's Slouch

One of my students pointed out that Sid's stand-straight-and-avoid-the-buzzer contingency was also a cued negative reinforcement/avoidance contingency, by which Sid escaped a conditional conditioned-negative reinforcer. Well, 1 hour of diagramming and two Diet Cokes later, I concluded the student was right.



So, my guess is that when Sid first started using the behavioral-posture apparatus, the proprioceptive stimuli arising from not standing straight (slouching) were conditioned negative reinforcers only because he had just heard the timer click on. They were conditional negative reinforcers. And then the preceding diagram applies. However, if Sid wore the apparatus more or less all the time, then I'd guess the proprioceptive stimuli arising from slouching may have become simple conditioned-negative reinforcers, and they would have continued to be negative reinforcers because of their consistent pairing with the loud tone, even if they had put a silencer on the soft click of the timer.

QUESTION

1. Diagram the negative reinforcement/avoidance contingency for the eye-contact procedure based on the work of Richard Foxx.

INDUSTRIAL/ORGANIZATIONAL BEHAVIOR MANAGEMENT

*Behavior-Based Safety in Hillary's Hypothetical Helicopter Hanger**

Hillary loves her workers, so she's really sad when one of them is injured or even killed. Also, the high rate of injuries and death is playing hell with her insurance rates. So Henry comes up with a great idea: Pay each worker a $20 bonus every 2 weeks when they aren't injured or killed. (OK, only when they're not injured.) Cool! . . . Well, not really cool. Why not? Cover the next paragraph, while you come up with a good reason why Henry's help isn't helpful. . . . Got it?

The supervisors told Hillary that the rate of reported injuries went way down, but that's it—*reported* injuries. They noticed that workers were limping, only using one hand and protecting the favored hand, looking a little beat up here and there, etc. What was happening? The workers were hiding their injuries, not getting help, coming to work when they should've stayed home recovering. Be careful what you pay for, or you might not get what you want. So what's the misplaced contingency on reporting injuries? Penalty. Each reported injury is penalized by a reduction in the bonus—negative punishment. So Hillary's consultants suggested she make her bonus reductions contingent on unsafe behaviors. And Hillary's little-boy nerd, Herman, came up with a tech procedure to help: Each time a supervisor saw a worker behaving unsafely, they'd push a button on their iPhone, which would automatically detect the face of the worker, deduct $10 from their weekly bonus, and ping the worker's iPhone, that is, give the worker negative feedback and show them how much they just lost. So what's this performance-management contingency? Careful now. Cover the next paragraph and think about it. . . . Got it?

Negative punishment? Ah, we're punishing not doing safe things, like not wearing a hard hat, or not wearing a safety harness, or not wearing protective gloves. Come on now; what test does that fail? . . . Cover the rest and think. . . . Of course, you've got it.

The dead-worker test, I mean the dead-man test. A dead man can "not wear a hard hat, safety harness, or gloves." In fact, most dead men don't. So what's really the behavior of interest? Think, etc. . . .

* Thanks to Jacob Kennell for coming up with this hypothetical example in our grad behavior-analysis seminar. And apologies to him for my twisting it all around.

Putting on the hat, harness, and/or gloves. And so what's the performance management contingency? They're putting on the safety gear to avoid the loss of some of their bonus. An avoidance contingency. Yes, they're avoiding injury, but now they're also avoiding the loss of a reinforcer—promised money. Avoidance of the loss of a reinforcer, or at least a promised one.

And to be more specific, is this a direct-acting contingency, like those in the Skinner box? Is the consequence, the after condition, 60" or less? No, the promised money loss doesn't occur until the end of the week, so it's an analog to avoidance of the loss of a reinforcer.

But what about the ping on the iPhone? Is that a negative reinforcer? Yes, probably a conditioned negative reinforcer, because it's been verbally paired with the loss of the bonus. So isn't that immediate punishment? Oh, no, I mean an immediate avoidance contingency? Well, would the delay between the behavior of putting on the safety equipment and avoidance of the ping be greater than 60"? Yes, usually, so the avoidance of the ping contingency is probably a verbally passed, rule-governed analog to an avoidance contingency.

Whew! And if you're tracking all this you're well on your way to becoming a very cool behavior analyst.

So, how successful was this intervention? Sorry, you'll have to wait until the results are published in the *Fictional Journal of Behavioral Safety*.

We've been talking about safety behavior and avoidance contingencies. But there are also unsafe contingencies to which positive and negative punishment contingencies would apply, like from the *Top 10 Most Common Workplace Injuries*: 10. On the Job Violent Acts (yes, really), 9. Repetitive Motion Injuries, 8. Machine Entanglement, 7. Vehicle Accidents, 6. Walking Into Injuries, 5. Falling Object Injuries, 4. Reaction Injuries, 3. Falling From Heights, 2. Slipping/Tripping, and 1. Overexertion Injuries.[7] And you could probably analyze many of these as involving behaviors that should not occur and, therefore, would be best performance managed by negative punishment, instead of, or in addition to, avoidance contingencies, either direct-acting or rule-governed analog contingencies.

We've sort of taken a flippant approach to this topic, because we wanted to lighten up the complexity of the contingency analyses, but this is really serious stuff: In 2018, work-related fatalities were 5,250[8] and injuries and illnesses were 2,800,000.[9] But behavior analysts are already starting to make a significant contribution to preventing injury and death, and with your help, we can make an even more significant contribution.

QUESTIONS

1. Discuss how behavior-based safety might best make use of different contingencies to increase safe behavior and decrease unsafe behavior in the workplace.
2. And also discuss the problem of paying bonuses for going without injuries.

DON'T BLAME THE VICTIM

But, it's too easy for us to cop out and blame the workers for their accidents and injuries:

Tom: It's their own fault. If they gave a damn, they'd be sure to wear all the safety equipment and do all the safety precautions. They shouldn't need these silly performance-management contingencies.

Yeah, right, like they don't care whether they lose a finger, get brain damaged, or even killed! The problem is that, risky though the job is, the probability of having an accident is too low for those natural contingencies to effectively control the workers' behaviors. Just like the probability of an accident was too low for your grandparents to buckle up, even though seat belts had been required for all new cars. Most of your grandparents didn't start buckling up until the states added their own performance-management contingencies, analogs to avoidance:

A moderate probability that Grandma will get a $20 ticket (traffic fine)➔Grandma buckles up➔a zero probability she'll get a ticket (at least for failing to buckle up)

But the worker's behavior isn't the whole story. Like 20-year-old Regina[10] dropped out of her community college so she could live with her fiancé and work 12 hours/day, 7 days/week in order to make enough to rent their own home. She worked at a company near her home in Alabama, a company that manufactured auto parts. One day a robot on the assembly line got stuck, but the workers had a manufacturing quota they had to fulfill, 420 dashboard frames per shift. And Regina got so impatient waiting for maintenance to come that she grabbed a screwdriver and went to fix it—which she did. But when the robot started up, it crushed her and also stuck two welding tips into her. She died in the hospital.

All Regina's fault?

Well, the company had not trained the line workers on the safety procedures they must use when dealing with the robot, like how to shut it down so it could not come alive in the middle of a repair and kill someone.

But the company may not have had the resources to provide all the safety training the workers needed.

Well, the company shouldn't have had such an unreasonably high manufacturing quota.

But the company had to meet the high production quotas their car-company customer was requiring of them.

Well, for sure, the company shouldn't have allowed Regina to work 12 × 7 = 84 hours/week!

But their employee turnover was so high, it needed as many employee hours as it could get to meet its own quotas.

In other words, the cause of the problems was the contingencies of reinforcement and punishment imposed on the administrators of the auto-parts company and on the administrators of the automobile company that bought the auto parts. These various behavioral contingencies resulted in Regina's death.

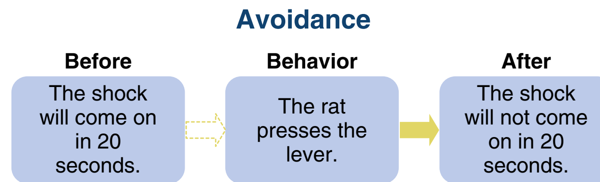
QUESTION

1. Give an example of victim blaming in industrial safety and explain why we should **NOT** be doing it.

TELEOLOGY

Teleology is the explanation of current events in terms of future events; it's saying the future causes the past. Here's a teleological explanation: *Our ancestors evolved ears and a nose so we, as their descendants, would have something to rest our eyeglasses on*. Most people, these days, consider teleological explanations to be logical errors. It does not seem plausible to us that something that hasn't even happened yet can affect something that is currently happening. For example, the evolution of ears and a nose obviously was not affected by the technological advances that made it possible to improve vision many centuries after that evolution. The invention of glasses did not cause us to evolve ears and a nose.

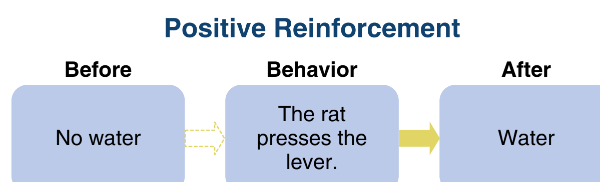
The reason we mention teleology in this chapter is that some of our more theoretically inclined students have asked if avoidance contingencies are not teleological and therefore illogical. These students raise the question of teleology because we say in the before condition, *the rat **will** get the shock in 20 seconds*.



And the way we draw the diagrams, with the arrow going from the before condition to the response, suggests that the before condition causes the response. In other words, it seems like we're saying that the prevention of the shock in the future is causing the current lever press. Right?

Wrong. We're not saying the prevention of the shock in the future is causing the current lever press in the case of the avoidance contingency. Instead, we're saying that the past instance where the lever presses prevented the shock reinforced the response class of lever pressing and that's why lever pressing increased.

It might help to look at a generic reinforcement contingency to understand the avoidance contingency.



We know that, in the preceding contingency, the first time Rudolph is in the Skinner box he doesn't press the lever even though he is water deprived. But eventually, through shaping or luck, he does press the lever and receives a drop of water. The water reinforces the lever press and his frequency of pressing the lever increases.

Reinforcers increase the behavior they follow. Avoidance of a negative reinforcer increases the behavior it follows. Neither outcomes affect behavior that is in the past. Both increase behavior in the future. And the arrow going from the before condition to the response means that the before condition precedes the response.

QUESTIONS

1. What is *teleology*?
2. And why aren't our avoidance contingency diagrams a teleological explanation?

Notes

1 Based on Azrin, N., Rubin, H., O'Brien, F., Ayllon, T., & Roll, D. (1968). Behavioral engineering: Postural control by a portable operant apparatus. *Journal of Applied Behavior Analysis*, *1*, 99–108.

2 This drawing is from Azrin, N., Rubin, H., O'Brien, F., Ayllon, T., & Roll, D. (1968). Behavioral engineering: Postural control by a portable operant apparatus. *Journal of Applied Behavior Analysis*, *1*, 102. Copyright 1968 by the Society for the Experimental Analysis of Behavior, Inc. It is reprinted with permission.

3 This section is based on Foxx, R. M. (1977). Attention training: The use of overcorrection avoidance to increase the eye contact of autistic and retarded children. *Journal of Applied Behavior Analysis*, *10*, 488–499. See also: Harris, S. L. (1975). Teaching language to nonverbal children with emphasis on problems of generalization. *Psychological Bulletin*, *82*, 565–580.

4 May, J. G., Risley, T. R., Twardosz, S., Friedman, P., Bijou, S., & Wexler, D. (1975). *Guidelines for the use of behavioral procedures in state programs for retarded persons*. Arlington, TX: National Association for Retarded Citizens.

5 This section is based on Hamlet, C. H., Axelrod, S., & Kuerschner, S. (1984). Eye contact as an antecedent to compliant behavior. *Journal of Applied Behavior Analysis*, *17*, 553–557.

6 Based on Pfiffner, L. J., & O'Leary, S. G. (1987). The efficacy of all-positive management as a function of the prior use of negative consequences. *Journal of Applied Behavior Analysis*, *20*, 265–271.

7 The Arbill Safety Blog. *Top 10 most common workplace injuries*. Retrieved from www.arbill.com/arbill-safety-blog/arbill-safety-bid-202877-top-10-most-common-workplace-injuries

8 U.S. Bureau of Labor Statistics. (2019, December 17). *Census of fatal occupational injuries summary, 2018*. Retrieved from www.bls.gov/news.release/cfoi.nr0.htm

9 U.S. Bureau of Labor Statistics. (2019, November 12). *2.8 Million nonfatal workplace injuries and illnesses occurred in 2018*. Retrieved from www.bls.gov/opub/ted/2019/2-point-8-million-nonfatal-workplace-injuries-and-illnesses-occurred-in-2018.htm

10 Waldman, P. (2017, March 23). *Inside Alabama's auto jobs boom: Cheap wages, little training, crushed limbs*. Retrieved from www.bloomberg.com/news/features/2017-03-23/inside-alabama-s-auto-jobs-boom-cheap-wages-little-training-crushed-limbs

PART X

Complex Processes II

CHAPTER 18

Shaping

Behavior Analyst Certification Board 5th Edition Task List Items		
G-7.	Use shaping.	Throughout
G-8.	Use chaining.	Pages 346–347

Example

BEHAVIORAL CLINICAL PSYCHOLOGY

Helping a Mental Hospital Resident Speak Again[1]

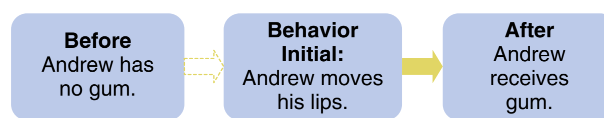
Andrew entered Big State Hospital when he was 21 years old, and from the day he entered, he hadn't said a word, though he had spoken earlier in his life. Nineteen years of silence in the hospital.

Andrew attended Dawn's group therapy session with patients who did speak. They talked about their feelings and problems. In one session, Dawn accidentally dropped a stick of chewing gum on the floor when she was taking a pen from her pocket. Andrew looked at the stick of gum. This was an unusual reaction, because Andrew always seemed to be in his own private world. The external world didn't exert much control over his behavior. So Dawn thought the gum might be a reinforcer for Andrew.

In the next group session, Dawn held a stick of gum in front of Andrew's face and waited until Andrew looked at it. Then Dawn immediately gave him the gum. Andrew opened his mouth and chewed it. After 2 weeks, Andrew looked at the stick of gum any time Dawn placed it in front of him. The sight of the gum reinforced looking at it.*

Dawn wanted Andrew to speak. In order to reinforce a behavior, that behavior must occur; in other words, no behavior, no way to reinforce it. And Andrew had not spoken for more than 19 years. Early in the third week, Dawn saw Andrew move his lips slightly. So she reinforced Andrew's lip movement with gum.

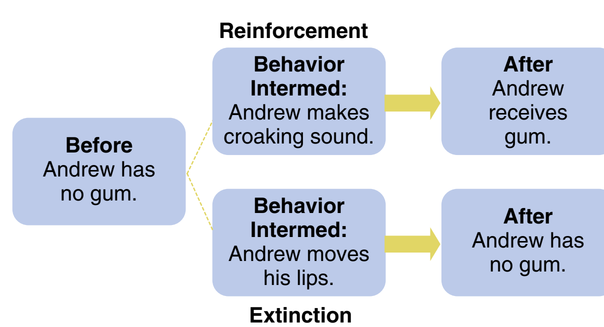
Simple Reinforcement



By the end of that week, Andrew was often looking at the gum and moving his lips.

One day, after Andrew made a croaking sound, Dawn said, "Say, 'gum, gum.'" Andrew began to make his croaking sound after her prompt. At first, the croak was like those she'd heard before. Dawn hesitated until the croaking sound faintly resembled *gum* and then reinforced the response. The next time, she waited until Andrew's sound more closely approximated *gum*. Then she reinforced that response.

Differential Reinforcement

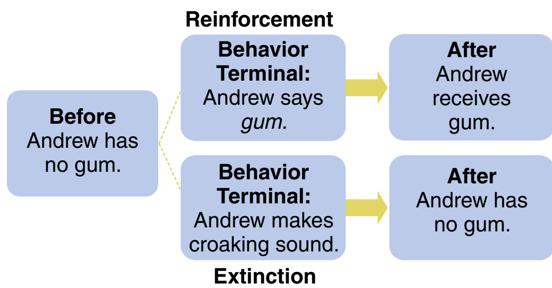


* The sight of the gum had previously become what we call a *conditioned reinforcer*, because it had been paired with the sweet taste of the gum (an unconditioned reinforcer). We study conditioned reinforcers in Chapter 12.

At the beginning of the fourth week, Dawn held a stick of gum before Andrew's face. Andrew looked at the gum and moved his lips. But she didn't give Andrew the gum as she had always done before. Then Andrew emitted a sound, and Dawn immediately gave him the gum.

By the end of the fourth week, Andrew was frequently making a croaking sound.

Differential Reinforcement



In the sixth week, Dawn had just asked Andrew to say *gum*, when Andrew clearly said, "Gum, please." Before the session had finished, Andrew was answering questions about his name and his age! After that day, he would answer any question Dawn asked. Also, he began chatting with her outside of the therapy sessions.

A nurse came to Andrew's room one day. Andrew smiled at her. So Dawn asked the nurse to visit Andrew daily. After a month, he began to answer her questions. That was the first time Andrew talked to anyone other than Dawn.

One sunny day, Andrew brought his coat and hat, gesturing that he wanted to leave. Without a word from Andrew, a new volunteer worker unfamiliar with Andrew's case took him outside. Dawn saw that Andrew didn't speak to the volunteer worker because he didn't have to; Andrew's gestures did the trick. Because he didn't talk, everybody assumed he couldn't, so they interpreted his gestures and signs. When two responses produce the same reinforcers, we tend to do the one needing the least effort. We may not intend to take the easy route; it just works that way.

Perhaps that's what had happened with Andrew. The contingencies of reinforcement had caused Andrew to drift down the stream of least resistance. Without anyone planning it, the contingencies reinforced responses less effortful than speaking, by producing those reinforcers most of us have to ask for verbally.

But the contingencies changed when Dawn entered Andrew's life. Dawn's contingencies required more and more effortful vocal and verbal behavior before she delivered the reinforcer.

Dawn asked the staff not to give their service and attention to Andrew unless Andrew asked for it. But not all the staff required Andrew to talk. So Andrew continued to speak to those who required it and was silent with those who interpreted his gestures.

By the way, notice that Andrew's complex talk came about after only 6 weeks of intervention. This is because he could speak 19 years ago. In other words, speech had been part of his repertoire.

QUESTION

1. Describe and diagram the procedure used to help a hospital resident speak again.

Concept

SHAPING WITH REINFORCEMENT (G-7)

Clear, fluent speech was the terminal behavior* Dawn chose for Andrew. (The **terminal behavior**** is the final goal of the intervention.) The terminal behavior didn't occur at all before shaping; its operant level was zero. (The **operant level** is the frequency of responding before reinforcement.***)

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* A terminology note of interest to only the most inquisitive: Usually we can use *response* and *behavior* interchangeably. But not always. I found I was writing *terminal behavior* and *initial response*. So to be consistent, I started to change to *terminal response*. But it didn't fit this sentence. I think this is why: *Response* tends to refer to a fairly narrow response class, like lever pressing, but behavior tends to include broader response classes, like fluent speech, as we've indicated earlier.

** Another picky terminology note: *Terminal behavior* and *target behavior* can usually be used interchangeably, but not always. Loud tantruming is sometimes shaped up from simple whimpers. As the parents habituate to a given level of crying, they accidentally pay reinforcing attention only as the child cries more and more loudly. We'd say the *terminal* (or final) *behavior* in that natural shaping process was loud tantruming, but not that it was the *target behavior*; the parent didn't intentionally shape the loud tantrums, it was *not* the parent's goal or *target*.

*** The concept of *operant level* comes from work in the Skinner box. The operant level is the frequency with which the rat presses the response lever before the experimenter introduces a reinforcement contingency for lever pressing. Normally the rat will have a low but measurable operant level of lever pressing. Now, that doesn't mean there was no reinforcer for pressing the lever; it might have been the sound of the lever clicking when it hit the bottom, or it might have been the feel of the lever on the rat's paws. Or the lever press might have been incidental to the rat's raising its body above the lever and putting its

If the operant level is lower than we want but still *significantly* above zero, we can use simple reinforcement. But if the operant level is at or near zero, there's nothing to reinforce differentially. So, when the response doesn't occur at all, we need to get trickier.

Definition: CONCEPTS

Terminal behavior

- Behavior not in the repertoire
- or not occurring at the desired frequency;
- the goal of the intervention.

Operant level

- The frequency of responding before reinforcement.

With Andrew, Dawn needed to get trickier. Using chewing gum as a reinforcer, first she reinforced lip movements, the **initial behavior**. Unlike the terminal behavior, the initial behavior must occur at least with a minimal frequency. Dawn reinforced lip movements until their frequency increased. Often the first phase of shaping involves only simple reinforcement to get the initial behavior occurring at a high frequency.

Then she chose a new behavior, emitting vocal sounds of any nature. She differentially reinforced this behavior until it occurred frequently, while extinguishing lip movements without any vocal-sound production.

Next, she differentially reinforced vocal sounds that more and more closely resembled the word *gum*, while extinguishing croaks and other sounds not resembling *gum*. Finally, she reinforced the terminal behavior, speech.

The initial and **intermediate behaviors** were prerequisites for the next behavior in the successive approximations. For instance, lip movement was a prerequisite for speech sound, and speech sound was a prerequisite for saying a word. (Unless you're a ventriloquist, you can't speak without moving your lips.) Dawn reinforced ***successive approximations*** to speech. She ***shaped*** the terminal behavior.*

Note that to shape Andrew's talking, Dawn used an added reinforcement contingency with the gum, but once he was speaking, she removed that added or artificial contingency because she could rely on the natural reinforcement contingencies that maintain the talking of most people. That's called a *behavior trap*—the natural reinforcement contingencies trap the behavior and keep it going without the initial training contingencies, without the gum.

Definition: CONCEPTS

Initial behavior

- Behavior that resembles the terminal behavior
- along some meaningful dimension
- and occurs at least with a minimal frequency.

Intermediate behavior

- Behavior that more closely approximates the terminal behavior.

Shaping with reinforcement

- The differential reinforcement of only the behavior
- that more and more closely resembles the terminal behavior.

Summing up: Use **shaping with reinforcement** when you want to bring about new responses. To shape with reinforcers, identify an initial behavior that resembles the terminal behavior along some meaningful dimension. The initial behavior must occur at least with a minimal frequency. Reinforce the initial behavior until it occurs frequently. Then abandon that response. Select and differentially reinforce another response that more closely approximates the terminal behavior. Continue this procedure until the terminal behavior occurs, and reinforce it until it occurs frequently.

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nose and whiskers along the top edge of the box. To be most precise, we might say *operant level* is the frequency of responding before the *experimenter, or teacher, or parent* added a reinforcement contingency, but we'll keep the formal definition a little simpler, as shown in the definition box. The *operant level* is the same as the baseline for the reinforcement intervention. But, normally, we wouldn't speak of the operant level before adding a punishment intervention contingency, at least not if someone had previously added a reinforcement contingency; normally, *operant level* applies only to reinforcement.

* The *method of successive approximation* and *shaping* mean the same; you can use either terminology. However, *shaping* has a more active connotation for us. *Shaping* makes us think of a keen-eyed behavior analyst reinforcing first one behavior and then another slightly different, shaping the behavior as a sculptor shapes a piece of clay. But *successive approximation* refers to the logical aspects of the procedure; it plays down Dawn's role.

QUESTIONS

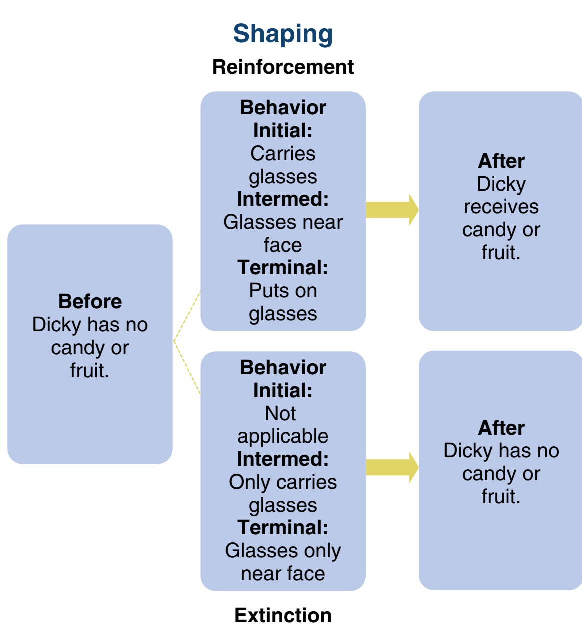
1. Define and give an example of the following concepts:
   - *terminal behavior*
   - *operant level*
   - *initial behavior*
   - *intermediate behaviors*
2. *Shaping with reinforcers*—state this principle and give an example. In your example, include:
   - the terminal behavior
   - the initial behavior
   - the intermediate behaviors
   - the response dimensions
   - the reinforcer
   - the results

Example

BEHAVIORAL MEDICINE

Helping a Child With Autism Wear Glasses[2]

Three-year-old Dicky was in danger of losing his eyesight. At 9 months of age, cataracts in both of Dicky's eyes clouded the lenses and blocked the passage of light. Dicky had a series of eye operations ending in the removal of both lenses. He was only 2 at the time. If Dicky were to see, he would have to wear corrective glasses for the rest of his life. For almost a year, his parents pressured him to wear glasses, but Dicky refused. They consulted several specialists. Each gave a new diagnosis, but none helped Dicky wear his glasses.



Dicky entered Western State Hospital in Washington when he was 3 1/2 years old. Dr. Montrose Wolf's team studied his case. Normally at this age, children develop rapidly and learn to interact with their world. But without good vision, they are at a great disadvantage.

The glasses on his head might have been aversive for Dicky, too uncomfortable. If so, taking off the glasses removed the discomfort—a negative reinforcement contingency. In other words, removal of physical discomfort might have reinforced taking the glasses off. And Dicky never left his glasses on long enough for the natural reinforcement contingency of seeing better to reinforce his putting on the glasses or for the loss of the better vision to punish his taking them off. Mont Wolf and his team would have to find a way to get Dicky to wear his glasses long enough for these other natural contingencies to take hold.

Mont Wolf's team started with frames without lenses, to prevent breaking the expensive prescription lenses. That way, later, they could switch to prescription lenses more easily. Each day, a member of Wolf's team spent two or three 20-minute sessions with Dicky in his room. The behavior analyst reinforced Dicky's carrying the glasses, bringing them closer and closer toward his face and actually putting them on—a gradual shaping process. Bites of candy and fruit were the presumed reinforcers. (Topography is the response dimension along which they were shaping Dicky's putting on his glasses.)

However, Dicky always failed to put the glasses on in the right position. He put them cocked to one side, with the ear pieces below his ears rather than on top of them. To correct these errors of placement, the behavior analyst put larger ear pieces on Dicky's glasses and fitted a bar from one ear piece across his head to the other ear piece. But nothing changed. Then the behavior analyst added a second bar to the back of the glasses, making them fit like a cap.

Now the glasses were easier to put on properly. But Dicky was progressing too slowly. Candy and fruit were not acting as reinforcers, maybe because Dicky wasn't hungry at the time of the sessions. So the behavior analyst withheld breakfast and continued using candy and fruit. Still nothing changed.

One day the behavior analyst tried ice cream. That hit the spot! It was the third session that day, and Dicky had eaten only a few pieces of cereal. The behavior analyst gave ice cream to Dicky each time he complied with requests. Progress was so fast during the first few minutes that the behavior analyst replaced lens-less frames with Dicky's prescription glasses. After 30 minutes of shaping, Dicky put the glasses on properly and looked through the lenses at various toys the behavior analyst displayed. After this session, Dicky improved rapidly. Soon he put on his glasses at mealtimes in his room.

At this point, Mont's team used other reinforcers that didn't rely on food deprivation. For instance, an attendant said to Dicky, "Put on your glasses and we'll go for a walk." Dicky complied. Favors, treats, excursions, and outings were available to him if he put on his glasses and didn't take them off. Soon Dicky was wearing his glasses 12 hours a day on the average. Excellent for any child his age. (Incidentally, the contingency to prevent Dicky's removing his glasses is a negative punishment contingency, a response-cost contingency—the loss of the favors, treats, and so on, if Dicky removes his glasses.)

Here's a problem we found interesting:

1. Is *wearing glasses* behavior?

a. yes
b. no

No, it fails the dead-man test; you could bury someone who was wearing their glasses. We hadn't realized this when we wrote earlier editions of this book; at that time, we still weren't fluent enough with our new friend, the dead man.

2. In terms of behaviors, what should we normally be talking about?

a. Putting on the glasses.
b. Taking off the glasses.
c. Both.

Yes, Mont's team had to both shape putting on the glasses and punish taking off the glasses. In terms of doing a proper task analysis of what is meant by *wearing glasses*, we must look carefully at both those component responses. Sometimes we still find it too convenient to use the term *wear*, but we should always make it clear that we really mean *putting on* occurs and *taking off* does not occur, and that the crucial behaviors of *putting on* and *taking off* are two separate behaviors under the control of two separate contingencies.

QUESTIONS

1. How would you shape putting on glasses? Include:

- the terminal behavior
- the initial behavior
- the intermediate behaviors
- the response dimensions
- the reinforcer
- the results

2. Is wearing glasses behavior? Please explain.

Compare and Contrast

DIFFERENTIAL-REINFORCEMENT VS. SHAPING WITH REINFORCEMENT

Differential reinforcement involves reinforcing a single set of responses within a response class and withholding reinforcement from another set of responses within that response class. So the frequency of the reinforced set of responses increases compared with the frequency of that non-reinforced set. The reinforced set of responses becomes differentiated from the other set.

It may occur to you that shaping and differential reinforcement are similar. They are. Both involve differential reinforcement; we reinforce a single set of responses, within a response class, and extinguish another set of responses, within that response class. Both procedures increase the frequency of one set of responses and decrease the frequency of the other.

But **shaping with reinforcement** consists of a series of successive differential reinforcements. After one set of responses has become differentiated from the other, we raise our standards; now we must reinforce another set of responses even closer to the terminal behavior. We use this shaping procedure when we want people to do a new behavior or one that almost never occurs. Simple differential reinforcement won't work in this case. To use simple differential reinforcement, the behavior we want to differentiate must occur often enough for reinforcement to have a reasonable effect. Simple differential reinforcement is not too effective at producing new or almost new responses. So, if the response rarely occurs, we may need to use shaping.

To distinguish between differential-reinforcement procedure and shaping, you should ask two questions. First, *does the terminal behavior occur at all now?* If it doesn't, *probably* we are talking about shaping; if it does, *probably* we are talking about differential reinforcement. For Dicky, the terminal behavior was to put on the glasses independently. Dicky didn't do it before the intervention. (Note: Sometimes we may use the shaping procedure when the response occurs, but at such a low frequency that it might take too long if we used simple differential reinforcement.)

Second, *does the procedure involve successive approximations to the terminal behavior?* If it does, we are talking about shaping; if it doesn't, we are talking about differential reinforcement. In Dicky's case, the behavior analyst reinforced different topographies. The topography of approaching the glasses differed from the topography of picking them up and from putting them on. The topography of correct placement differed from incorrect placement, although the difference was of a lesser degree. Each topography successively approximated the terminal behavior.

Differential Reinforcement vs. Shaping With Reinforcement

	Reinforcement	Shaping
Some terminal behavior at the start	Yes	No
Successive approximations to the terminal behavior	No	Yes

QUESTIONS

1. Construct a table comparing differential reinforcement with shaping.
2. Give a pair of related examples showing these differences.

Example

BEHAVIORAL SPEECH PATHOLOGY

Raising the Voice Intensity of an Aphonic Child[3]

Thirteen-year-old Melanie had been aphonic for several years. This means her voice sounded like a low, raspy whisper. Although articulate, her speech was of such a low intensity that people couldn't understand what she was saying. Melanie's parents took her to one doctor after another; the only result was that she came to dislike doctors. At last, she visited Drs. Bangs and Friedinger—professional behavior analysts who took great pains to win Melanie's affection and respect.

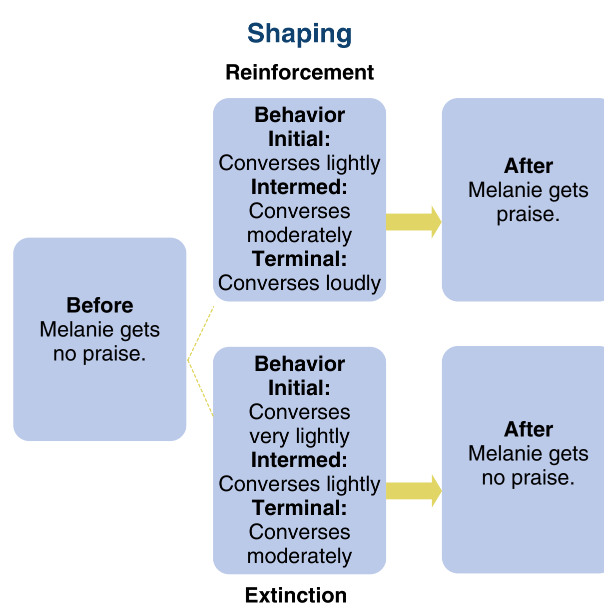
Of course, approval is a reinforcer. But noncontingent kindness, friendship, and approval will not be enough. To be most effective, they must immediately follow the response you want to reinforce. That's what the behavior analysts did. They immediately praised and approved Melanie's attempts to comply with their requests.

They started by reinforcing her compliance with breathing exercises, similar to the exercises that singers and public speakers practice. These exercises make the voice stronger and might develop greater speaking force.

Next, they asked Melanie to hum. But her humming was as faint as her speaking. So they praised successive approximations to normal humming intensity until it reached normal. They reinforced approximations to saying consonants and then reading aloud. However, Melanie read softly, like a whisper. They asked her to try harder, and if she succeeded even by a barely noticeable amount, they praised her efforts. Reading intensity increased until it reached normal intensity. Finally, in conversation, they reinforced intensities of her speech that were higher than previously. Soon Melanie talked at a normal intensity.

Helping Melanie involved a series of successive approximations; first, they shaped breathing, then humming, then saying consonants, then reading, and finally conversing. It's not clear if they really needed to go through the whole series; it may be that if they had simply started with the last topography, conversing, they would have gotten the same excellent results.

Note that the reinforced behavior or intensity of behavior in the initial phase was extinguished in the intermediate phase; and the reinforced behavior or intensity in the intermediate phase was extinguished in the terminal phase.



With these shaping procedures, the behavior analysts got rid of a problem Melanie had suffered for many years. And it took them only ten sessions! But even more important is that Melanie's change was permanent, as the behavior analysts verified 2 years later. Melanie spoke loud and clear in a routine follow-up.

QUESTIONS

1. Describe a shaping procedure to raise voice intensity. Include:
   - the terminal behavior
   - the initial behavior
   - the intermediate behaviors
   - the response dimension for each behavior
   - the reinforcer
   - the contingency
   - the results
2. OK, you've nailed the basics of shaping so the next time you go into class, explain to your teacher how you'd shape baseball playing starting with t-ball.

Example

EVERYDAY LIFE

Shaping With Punishment

Sid's Seminar

Sid: I've bet Juke Jackson 20 bucks. If he loses, we'll have a party this weekend. And he isn't here, so looks like we won.

Juke: (Enters the room, out of breath. . .) Wait a minute, we didn't bet I'd be on time.

Sid: Excuuuse me! My man, you are on.

Juke put his briefcase on a desk, hung his coat on the back of a chair, emptied his pockets, unbuttoned his cuffs, and rolled up his sleeves. Then he moved Sid's desk against the blackboard to clear space in front of the class. And without another word, he crouched down, leaned forward, and soon, he was standing on his head, his hands balancing him, his legs straight in the air, a vertical rod, not a muscle twitch. And he stayed perfectly still, 1, 2, 3, 4, 5 minutes, until the class started applauding and cheering wildly; then he gracefully flipped over and stood up and bowed with solemn dignity.

Sid: Gang, we lost the party, and I lost 20 bucks. Juke tried to stand on his head a month ago but almost ended in the hospital. And I said he'd never be able to do it, even with the football team's help. That's when we came up with the bet.

Juke: Simple, I know the principles of behavior work, don't you? (Immediately all the students looked at Sid, and smiled silently.)

Sid: (Clearing his throat) Well, why don't you tell us how you did it?

Juke: It took time, practice, and a little behavior analysis. I knew my muscles were strong enough; I just wasn't balancing properly. To begin, I started with my legs over my head, leaning against the wall. It was hard. Gravity worked against me. I'd fall, and almost fall. Behavior analysis vs. physics. But I kept practicing until I could hold my feet against the wall for a minute. Then I raised the criterion; I tried to stand on my head without touching the wall. Again, I fell and almost fell. But I got better and better; I stopped falling, and stopped almost falling, and after a lot of practice, I got to the place where I don't even wobble, my legs straight above my head. What a feeling of accomplishment.

Sid: Was that an example of the shaping procedure?

Joe: Yes, Mr. Jackson's standing on his head with straight-up topography and long durations was at a zero operant level before training, and he acquired responses that successively approximated the outstanding performance he just demonstrated.

Sid: Excellent. You get a point. Now, a hard one: What was the contingency?

Sue: Punishment. Wrong moves immediately caused Mr. Jackson to fall or almost fall or wobble.

Tom: Wrong! Reinforcement. Right moves caused Juke to feel good about himself. Isn't that true, Juke?

Juke: It sure did. But hurting and almost hurting and looking clumsy because of dumb moves also had a lot to do with it.

Tom: But the target behavior was to do it right, not to do it wrong.

Sue: It depends on how you look at it.

Tom: But shaping brings about new responses. And you can't bring about new responses with punishment, can you?

Sid: Look at it this way: Shaping with reinforcement is like the sculptor who starts to work with a handful of clay and adds to it, molding it with her hands. **Shaping with punishment** is like the sculptor who starts with a piece of solid granite and chisels pieces out until she has her sculpture. In shaping with reinforcement, she adds; and in shaping with punishment, she takes away. But in both cases, she gets her sculpture. I think shaping with punishment and reinforcement both played a role in my losing 20 bucks.

Definition: CONCEPT

Shaping with punishment

- The differential punishment of all behavior
- **except** that which more and more closely resembles the terminal behavior.

As with all punishment procedures, the general response class needs some history of reinforcement. In the case of shaping with punishment, at least the non-punished terminal behavior and its approximations need to be reinforced. Otherwise, the punishment would suppress the entire response class. If some reinforcement contingency were not maintaining Juke's attempts to stand on his head, the punishment of falling would soon suppress all such efforts.

QUESTION

1. *Shaping with punishment*—define it and give an example. Include:
   - the terminal behavior
   - the initial behavior
   - the response dimension
   - the shaping procedure
   - the punishment contingency
   - the reinforcement contingency
   - the results

Example

EVERYDAY LIFE

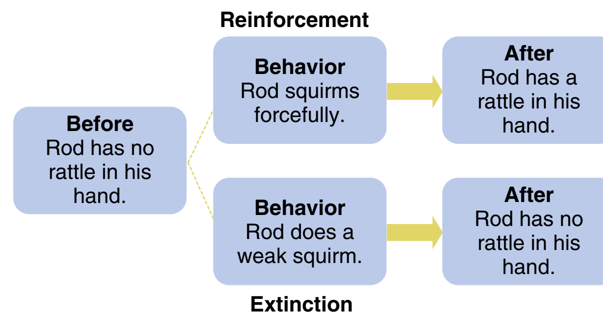
Learning to Walk and Run: Variable-Outcome Shaping

Little Rod's sitting in one corner of his crib, bored. Nothing's shaking. Ah, but his favorite toy, his rattle, is in the opposite corner. He leans toward it; too far. He squirms toward it, and finally scores the rattle. Now it's shake, rattle, and roll. And what can be more reinforcing than noise you, yourself, produce?

However, it was a long, slow haul from one corner of the crib to the other for little Rod the squirmer. And over the next few weeks, Rod got better and better at squirming, to the point that his squirm evolved into a crawl. And over the next few months, his crawl evolved into a toddle. Then the toddler became a walker and finally a runner.

But how'd that happen? It's natural; it just happens. Yes, but what's the behavioral process underlying this natural happening? Differential reinforcement and shaping.

Differential Reinforcement Along the Force Dimension



The natural environment differentially reinforced squirming. Force was the response dimension. Rod got the reinforcing rattle, but only if he squirmed with sufficient force.

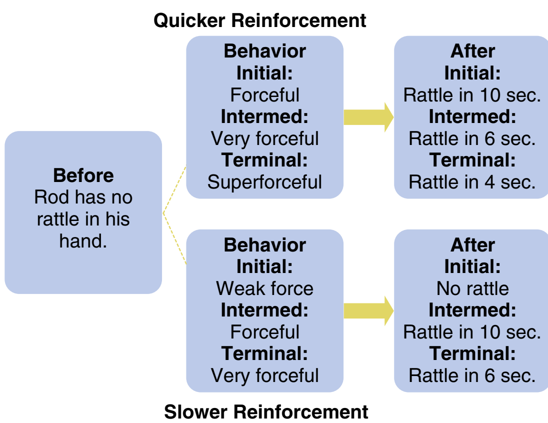
At first, it took a long time for Rod to squirm from one corner of the crib to the other. But, after a while, he became such a forceful little squirmer that he was onto the rattle in a jiffy. Now even though there might be some muscle development involved, we're talking mainly about skill acquisition. In other words, the natural environment shaped more and more forceful squirming. But how did that happen? After Rod had become a forceful squirmer, did Father Nature stop giving the rattle until Rod did a very forceful squirm? And then after Rod became a very forceful squirmer, did Father Nature stop giving the rattle until Rod did a super-forceful squirm?

No, nature doesn't usually shape like that. It's just that the more forcefully Rod squirmed, the more quickly he got to the rattle. And getting to the rattle quickly is more reinforcing than getting to it slowly. So the more forcefully Rod squirmed, the more quickly he got the rattle, and thus the bigger the reinforcer; getting the rattle in 6 seconds is more reinforcing than getting it in 10 seconds, and getting it in 4 seconds is more reinforcing than getting it in 6 seconds.

Father Nature differentially reinforced the initial behavior of forceful squirming by giving Rod the rattle in 10 seconds vs.

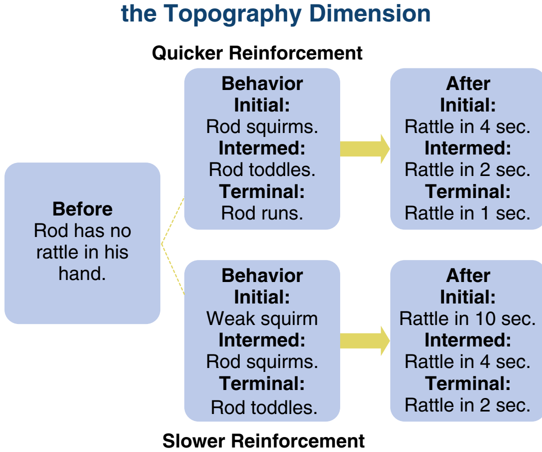
not getting it at all. Then he differentially reinforced Rod's intermediate behavior of very forceful squirming by giving the rattle in 6 seconds instead of 10. And finally, he differentially reinforced Rod's terminal behavior of super-forceful squirming by giving the rattle in 4 seconds instead of 6. The delay to the outcome varied, depending on how fast Rod squirmed; and the variation in the delay to the outcome shaped faster and faster squirming—**variable-outcome shaping**. And how did Rod move from the squirmer class to the crawler, toddler, walker, and finally runner class? Again, through **variable-outcome shaping**, the natural environment shaped the different topographies of movement. And again, each improvement in topography from squirming to running produced a more immediate rattle, and thus a more powerful reinforcer.

Variable-Outcome Shaping Along the Force Dimension



For example, when Rod performed at the intermediate level, toddling was reinforced with the rattle in only 2 seconds (as seen in the top two white boxes), but if he slipped back, squirming would be reinforced with the rattle with a delay of 4 seconds (as seen in the bottom two gray boxes).

Variable-Outcome Shaping Along the Topography Dimension



The world is a skills factory for little Rod; every day, it helps him learn new skills and improve his existing ones, often through variable-outcome shaping.*

Why does Rod complete his Barney puzzle more and more quickly as time goes by? Because he gets the reinforcer (sight of a completed puzzle) more quickly when he puts the pieces together in the right order more quickly. And, perhaps even more immediately, he gets the reinforcing sight of one more piece in place more quickly when he puts that piece in the right place more quickly; there are a lot of these little reinforcers leading the way to the big reinforcer of the completed puzzle. So probably this is also variable-outcome shaping. In general, variable-outcome shaping will produce improved skills if they result in getting the reinforcer more quickly.

QUESTIONS

1. Diagram a variable-outcome shaping procedure to improve squirming as a means of locomotion.
2. Diagram a variable-outcome shaping procedure to improve locomotion from squirming up through running.

Compare and Contrast

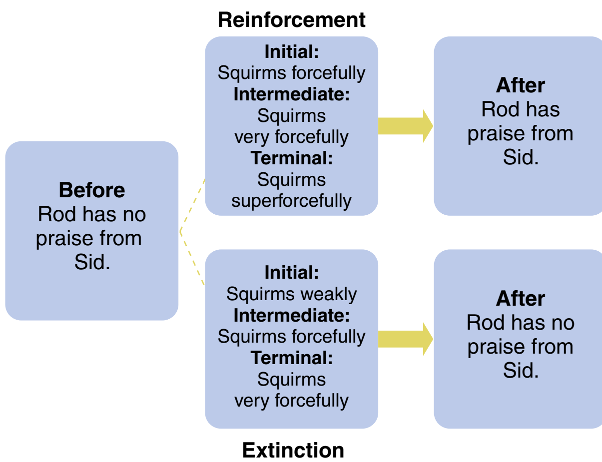
FIXED-OUTCOME SHAPING VS. VARIABLE-OUTCOME SHAPING

Usually, nature shapes behavior using **variable-outcome shaping**. The more skilled the behaver, the bigger, the better, or the quicker the reinforcer. Let's contrast Father Nature's variable-outcome shaping with Father Sid's **fixed-outcome shaping**. As part of his effort to use training to create Rod the Superkid, Sid added a fixed-outcome shaping procedure to nature's variable-outcome shaping. At first, each time Rod squirmed forcefully enough to get to the rattle, Sid jumped up and down with enthusiastic joy and rained praise on Rod. Then, after Rod was reliably, though slowly, squirming to the rattle, Sid raised the criterion for his praise; now Rod had to squirm with sufficient force that he got there in 6 seconds, before Sid would get excited and praise him. And then he raised the

* Of course I've simplified this example quite a bit, to keep it from getting out of control. Nature's training occurred with more reinforcers than the rattle and in more settings than Rod's crib. Also, the crib might not be the ideal place to learn to run. (Incidentally, I don't think anyone's done an analysis of the natural shaping of a general skill such as locomotion simultaneously in many different settings with many different reinforcers.)

criterion again to 4 seconds. But each time, the outcome Sid used as the reinforcer remained the same, his excited praise.

Fixed-Outcome Shaping Along the Force Dimension



Please look at the earlier diagram of Rod's behavior being shaped by nature to squirm with more force and contrast it with this one. What's the difference?*

Nature's variable-outcome shaping is just like the human trainer's fixed-outcome shaping except for three things:

1. As the names imply, with variable-outcome shaping, the outcome varies (improves) as the performance improves (moves from the initial behavior to the terminal behavior), while with fixed-outcome shaping, the outcome remains the same as the performance improves.
2. With variable-outcome shaping, it is always possible to get a reinforcer if the performance slips back to a lower level (e.g., from the intermediate behavior to the initial behavior); it's just that the reinforcer will be less. But with fixed-outcome shaping, if the performance slips back to a lower level, that performance will receive no reinforcer.
3. Variable-outcome shaping is usually an unplanned interaction with the natural environment, and fixed-outcome shaping is usually a planned interaction with a trainer (behavior modifier).

* As one of my students pointed out, our example of Father Sid's fixed-outcome shaping is a little more complex than I'd indicated: True, Sid held constant the amount and quality of his praise, regardless of the force of Rod's squirming, so Sid *was* using fixed-outcome shaping. However, Rod got his dad's praise more and more quickly as he squirmed more and more forcefully and thus got to the rattle and Dad's praise more and more quickly. So this shaping procedure has a variable-outcome component as well as the fixed-outcome component.

Fixed-Outcome vs. Variable-Outcome Shaping

	Fixed outcome	Variable outcome
Number of outcome sizes	One	Many
Regression to earlier levels	No reinforcers	Weaker reinforcers
Usual source of shaping	Behavior modifier (planned)	Nature (unplanned)

Now let's look at some other examples: Remember Melanie? The behavior analysts used a classic shaping procedure with her. They gradually required better and better speech before they'd reinforce her efforts with praise. They gradually raised their standards for reinforcement. But they kept the value of the reinforcer the same, all the way along. The reinforcer remained the same, but the standards increased—fixed-outcome shaping. However, the natural shaping contingency would involve a variable-outcome: the better her speech, the quicker the reinforcing response from her listeners.

Here are a couple of other examples of the planned, or programmed, shaping used by behavior modifiers—fixed-outcome shaping. Dawn used the same size of a reinforcer (a single stick of gum) but kept raising the criterion for reinforcement (closer approximations to language). Also, Bangs and Friedinger seemed to use the same size of a reinforcer (praise) but kept raising the criterion for reinforcement (Melanie's closer approximations to normal speech intensity). And in these two cases, as well, the natural shaping contingency would involve a variable outcome: the better the speech, the quicker the reinforcing response from the listeners.

The natural, unplanned, or nonprogrammed automatic shaping of Father Nature is usually variable-outcome shaping. Learning most skills involves this sort of nonprogrammed, automatic, variable-outcome shaping: Your tune on the guitar sounds better and better, as your skill in playing it improves. The tennis ball skims over the top of the net with greater and greater speed, as your serve improves. The golf ball stops closer and closer to the hole, as your stroke improves.

But it's not just artistic and athletic skills; Father Nature also uses variable outcomes in shaping our skills of everyday life: As we learn to speak, the more clearly and loudly we ask for a cookie, the more quickly we get it. The more accurately we aim our spoon of mashed potatoes, the more potato we get in our mouth and the less we get on our face.

While most instances of variable outcomes may involve natural, unplanned shaping, sometimes people do intentionally use variable-outcome shaping when teaching skills. For instance, in shaping the articulate speech of a child with autism, we may intentionally be more enthusiastic in praising speech that is more articulate. However, I know of no data showing that this variable-outcome shaping works any better than fixed-outcome shaping. (In fact, I suspect the child will acquire articulate speech more quickly if the tech praises with wild enthusiasm each time the child meets the current articulation criterion.)

Definition: CONCEPT

Fixed-outcome shaping

- Shaping that involves no change in the value of the reinforcer,
- as performance more and more closely resembles
- the terminal behavior.

Variable-outcome shaping

- Shaping that involves a change in the value of the reinforcer,
- as performance more and more closely resembles
- the terminal behavior.

By *value* in these two definitions, I mean the magnitude, intensity, quality, or delay of the reinforcing or punishing outcome.

Both fixed- and variable-outcome shaping can involve any of our basic behavioral contingencies, not only reinforcement but also escape, punishment, and penalty; you can visit DickMalott.com to see how that works.

QUESTIONS

1. *Fixed-* and *variable-outcome shaping*—define them.
2. *Fixed-outcome shaping and variable-outcome shaping*—diagram two similar examples showing the difference.
3. Fill in a table contrasting fixed- and variable-outcome shaping and explain it.

Shaping's really cool, and when working with kids with autism, even behavior analysts often make the mistake of prompting responses or using physical guidance rather than shaping. For example, when running a teaching session with a child, it often seems to work better if the child is looking at us when we give an instruction such as "Touch the green circle." So a behavior tech will often use physical guidance to more or less force the child to look at him. Or the tech will hold the reinforcer, for example, an M&M, in front of his own face to entice the child to look at him. At our practicum site, we've found it seems to work better simply to shape the looking response: Every time the child looks even vaguely in our direction, we give her an M&M, then we gradually increase our requirement until she must look us directly in the eye and hold the gaze for a couple seconds before she gets the M&M. And finally we require her to look at us and follow our instruction, for example, "Touch the green circle," before she gets the M&M. Often, the main problem is not the kid, it's us; we have a hard time resisting over prompting.

Notes From the Skinner Box

LOOSENING UP A BIT

Yesterday I was so happy spending an hour in our undergrad rat lab for the first time in years, though I'm a fanatical advocate of the rat lab.

But it looks like we don't have good shaping criteria. Finally, after gradually reinforcing closer and closer approximations to the lever press, Rudolph the Rat presses it a couple times. Wonderful! But then he wanders around the box for several minutes without pressing it, and the students sit there getting bored while waiting for another lever press.

So I think we need some sort of criterion like this: If we go for one minute without a response that meets the current criterion level for a lever-press approximation, we lower our requirement and reinforce the next reasonable approximation to it. Like, if Rudolph doesn't get a reinforcer every minute, we lower the criterion until he does get one in the next minute. Suppose he touched the lever with his paw a couple of times, and we now require him to at least touch the lever before he gets his drop of water. But now it's been three minutes, and he still hasn't touched it again. Watch out, he may just go into the corner and take a nap. So instead, you might have some shaping rule like this: No lever touch in the last minute, then reinforce just moving toward the lever or even just looking at the lever. Not sure if one minute is the right time interval; maybe it should be shorter, or maybe longer. But hopefully, by the time for *PoB* 9e, someone can propose a research-based criterion.

And like everything else in the Skinner box, this has serious implications. We run into the same problem when shaping the behavior of our nonverbal clients, like autistic children. Maybe we need some sort of explicit criterion to decide when to revert to an earlier approximation to the terminal response.

And yes, such a criterion may be most valuable for people who are just learning how to shape behavior, whether it's the behavior of Rudolph or of a child. In other words, it is often said that shaping is more of an art than a science. In other, other words, the shaper's behavior of skillfully shaping may itself have been shaped by many previous successes and failures of shaping, and now the skillful shaper's behavior is directly controlled by that reinforcement history, and that skillful shaping may not be governed by any rules that he or she can state.

In the Skinner Box[4]

EXPERIMENTAL ANALYSIS OF BEHAVIOR

Shaping With Reinforcement

In Chapter 11, you differentially reinforced Rudolph's lever presses of 1 inch or more. This time you'll work with the force dimension rather than distance. (You'll use something like a tiny set of scales to measure the force of his lever presses.) Before you start the differential-reinforcement procedure, the frequency graph of the forces of Rudolph's lever presses might look like Figure 18.1.

No big deal. But now, you want Rudolph to press the lever with a force of 100 grams. This is a big deal. It's so big that if you wait until he does it once so that you can reinforce it, you'll wait forever. He'll never press the bar with that force unless you reinforce lever presses of successively increasing forces.

If you've got a sharp eye or a magnifying glass, you can see in this graph that several of Rudolph's lever presses were greater than 11 grams, though the peak was around 8 grams. So you should succeed if you try to differentially reinforce presses of 11 grams or more. That means you'll reinforce all presses of at least 11 grams and extinguish those of lesser force. Soon most of his presses tip the scales at least 11 grams (Figure 18.2).

You're doing well, but you've sure got a long way to go to get Rudolph up to 100 grams.

This time, notice that some of his lever-press forces are at or above 20 grams, though the peak is at 14 grams. So why don't you raise your criterion to the 20-gram value? It's time to differentially reinforce all forces at or above 20 grams and extinguish the others (Figure 18.3).

Not bad. And now you're getting quite a few 35-gram responses. So you can jump your criterion up to that level

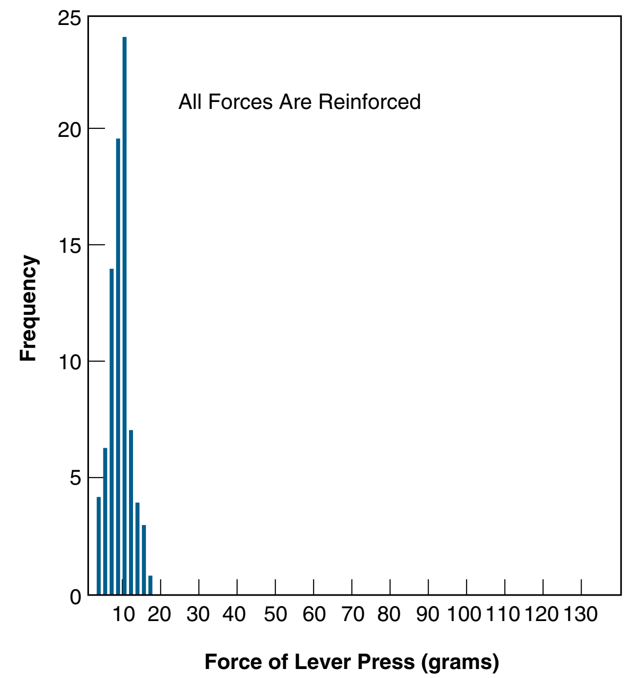


Figure 18.1 Frequency Graph Before Differential Reinforcement

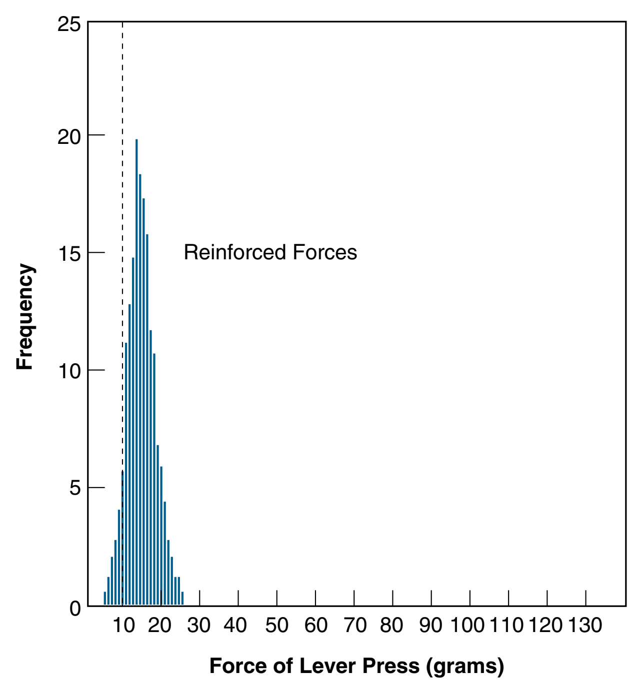


Figure 18.2 Frequency Graph After Differential Reinforcement of 11-Gram Presses

now. You know what you'll get; the most frequent forces will be around 35 grams, but sometimes Rudolph will put a few over the 55-gram limit. This means you can raise your criterion

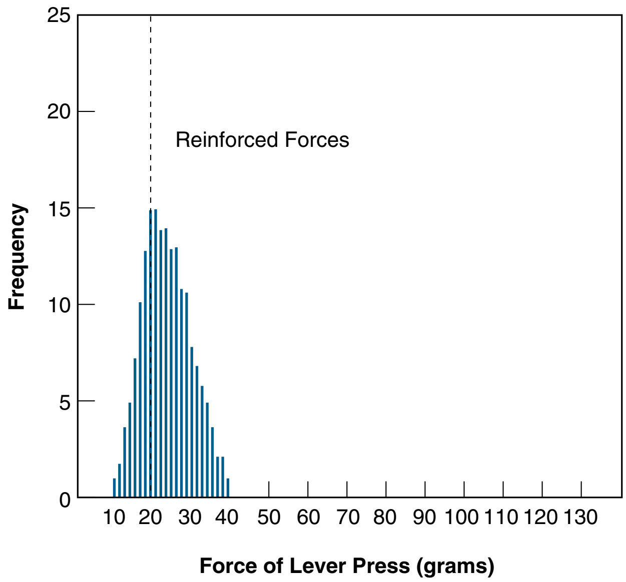


Figure 18.3 Frequency Graph After Differential Reinforcement of 20-Gram Presses

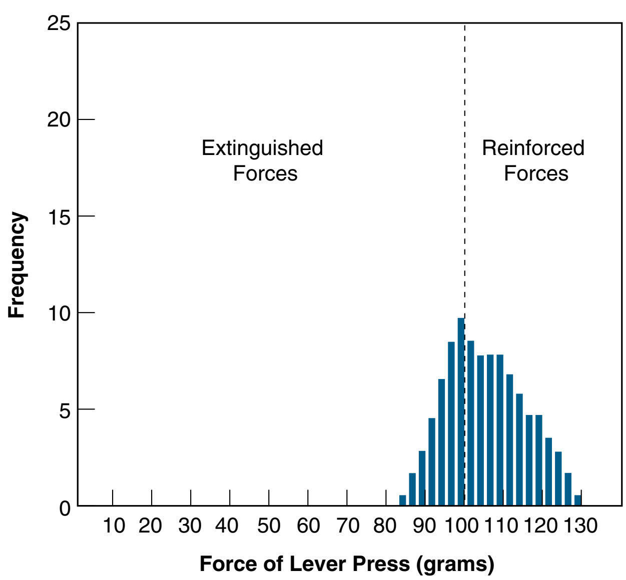


Figure 18.4 Frequency Graph After Differential Reinforcement of 100-Gram Presses

to that value, and then on and on, until you and Rudolph have hit the 100-gram goal. Your final results should look something like Figure 18.4.

Now you've got it. Now you've got an amazing 100 grams of force that resulted from your using shaping with reinforcement—a series of differential-reinforcement procedures where you raised the force criterion in successive approximations. (In reality, you probably would have moved through the successive approximations much more rapidly than the graphs show. You might have increased your force requirement in smaller steps and stayed at each level only long enough to get a few responses at a slightly greater force.)

QUESTION

1. How would you shape lever presses of 100 grams of force using a reinforcement contingency?

Compare and Contrast

RESPONSE SHAPING, STIMULUS FADING, AND REINFORCER REDUCTION

People often confuse stimulus fading with response shaping, as well as with a procedure we'll call *reinforcer reduction*. First, let's review ***response shaping***: Before using response shaping, we decide on a goal—the terminal behavior. We select a response resembling the terminal response, reinforce it, and then reinforce successive approximations to the terminal response. We move our criterion for reinforcement closer and closer to the terminal response until the participant ultimately does the terminal response. The type of response we reinforce changes as the frequency of that response increases. The response we initially reinforce may resemble the terminal response in only a superficial way. We soon discard and exchange this response for one that more directly resembles the terminal response.

At first glance, ***stimulus fading*** may appear similar to response shaping, because in both cases, things change gradually. But, unlike response shaping, the gradual change in a stimulus-fading procedure involves the stimulus and not the response. Thus, in response shaping, the response itself changes because of differential reinforcement. But, in stimulus fading, the response stays the same, but the values of the stimuli change.

A similar type of gradual change may entail the replacement of one type of reinforcer for another—***reinforcer reduction***. Here's a common example: We might first reinforce a child's response with a primary reinforcer, such as food or ice cream. Then we gradually reduce the amount or frequency of the food, while replacing it with praise or other social reinforcers. Or a rat may first receive three pellets during reinforcement when learning a new response, but after the response is mastered, only one pellet for reinforcement is needed to maintain that response. We can use the concept *reinforcer reduction* to refer to all these variables—schedule, amount, and type of reinforcer reduction. A gradual reinforcer reduction may be an important part of a behavior-analysis plan.

Each of these three procedures is conceptually independent and can occur without affecting the other two. In practice, we may find it useful, or necessary, to use two or even all three procedures to get the desired result. We might also use reinforcer reduction to transfer control from the added performance-management contingency to some built-in, natural contingency. In the table we compare these techniques of gradual change—response shaping, stimulus fading, and reinforcer reduction.

Techniques of Gradual Change

Procedure	Area of Application	Purpose
Response Shaping	Response differentiation	To bring about a response not previously made by the organism
Reinforcer Reduction	Type and amount of reinforcer	To maintain responses already made or to establish a particular pattern of responses*
Stimulus Fading	Stimulus discrimination	To bring the response under the control of stimuli that didn't exert control initially

* We might also use reinforcer reduction to transfer control from the added performance-management contingency to some built-in, natural contingency.

QUESTIONS

1. Give an example of each of the following techniques:
   a. shaping
   b. fading
   c. reinforcer reduction
2. What are the differences between these three procedures?
3. What are the similarities?

In the Skinner Box

EXPERIMENTAL ANALYSIS

Shaping With Punishment

Suppose you want to shape the 100-gram lever press using differential punishment and *no* differential reinforcement. You need to use a reinforcement procedure to get the bar press occurring in the first place, so you might use food pellets as the reinforcer. And you need to keep the food reinforcement going throughout the entire differential punishment procedure; otherwise, the bar press will extinguish.

Then you differentially punish lever presses of less than 20 grams of force. But when Rudolph presses the lever with a force of less than 20 grams, he gets food and an aversively loud noise as soon as he releases the lever. However, when he presses the lever with a force of at least 20 grams, he gets only food, no loud noise. After Rudolph reliably presses the lever with a force of 20 grams, you raise the criterion to 40 grams. Now any response with a force of less than 40 grams gets food and loud noise. As Rudolph matches each new criterion, you raise it until he's pressing the lever with a force of 100 grams.

QUESTIONS

1. How would you shape lever presses of 100 grams of force using a punishment contingency?
2. To shape 100-gram lever presses with punishment, do you need to keep a reinforcement contingency going throughout the entire shaping procedure? Please explain.

Compare and Contrast

SHAPING VS. GETTING IN SHAPE

When Sue came to Big State U, she moved into the dorms and acquired the freshman 15—the 15 pounds all freshmen gain when they live on dorm food. As a sophomore, she left the dorms, but she didn't leave those 15 extra pounds.

However, Sue was not one to take her fat fanny sitting down. She stood up, and she started shaping up. She borrowed her friend's favorite Jillian Michaels exercise DVD. At first, she could get through only half the tape before, exhausted, she plopped back onto her couch and became a spud.

Yet she kept at it, day after day, increasing both the duration and the vigor of her exercise. After a few months, she could go through the whole tape without pushing the pause button or even glancing at the couch. The vigor of her exercise increased almost to Jillian's level. Oh, yes, with a little extra help from a 1,200-calorie diet, she could now get back into her high-school jeans.

Question

Is this an example of shaping?

Our Answer

No. Getting in physical shape is not the same as shaping behavior. In Sue's case, it was physically more or less impossible for her to last much more than half the tape before she was exhausted. She didn't have strong enough muscles in her arms and legs or the aerobic capacity in her heart and lungs. But Andrew had the muscle development he needed for speaking, as did Dicky for wearing his glasses, Melanie for speaking with a normal intensity, and Juke for standing on his head.

Melanie's aphonia is a nice example of the distinction. Didn't she have strong enough muscles to speak above a whisper? If not, Bangs and Friedinger were shaping up her body. Or didn't she have the skill or perhaps the need to speak above a whisper? If not, they were shaping her behavior. (We suspect it was her behavior and not her body, because she needed only 10 shaping sessions to acquire normal speech intensity. That seems too brief to shape up the body.)

Let's look at it another way: Differential reinforcement is the building block of shaping. True, differential reinforcement shapes Sue's athletic skills, but it doesn't shape up her muscles. Reinforcement, differential reinforcement, and thus shaping increase the likelihood of a response class for which the organism already has the physical prerequisites. Getting in shape might shape up the physical prerequisites for a response class. Similarly, after a few months of training Sue might be able to run a faster mile, but that's largely a result of increased muscle strength, getting in shape, not shaping. Yes, we use *shape* in almost the same ways. And, yes, the two processes are analogous. But one is psychological and the other biological, so if your professor asks for an example of shaping, do not use getting in physical shape.

QUESTION

1. Is shaping the same as getting in shape? Of course not. Why not?

Compare and Contrast

IN THE SKINNER BOX

Shaping vs. Behavioral Chaining (G-8)

In Chapter 19, we'll formally introduce and define **behavioral chains**—a sequence of responses linked together with connecting stimuli. For example, in the Skinner box, Rudolph's lever pressing consists of a behavioral chain: Rudolph raises his head and sees the lever; he walks over to the lever and sees it up close; he raises his paws above the lever and sees the lever from a different view and feels the proprioceptive stimuli resulting from his standing on his hind feet; he presses down on the lever and hears the click of the water dipper; he walks over to the water dipper and sees it up close; he bends down and licks and gets that delicious, soul-satisfying, immensely reinforcing drop of water. So, when you train Rudolph to press the lever, you're setting up an elaborate behavioral chain, much more than a mere lever press. This will be discussed in more depth in Chapter 19, but we mention it here because it's important to distinguish between shaping and chaining.

Now, people often make the mistake of calling this lever-press training procedure *shaping*, but it isn't; it's *chaining* or *training a behavioral chain* because it involves a series of different responses (i.e., *response classes*) behaviorally chained together. (For example, looking toward the lever, approaching the lever, pressing the lever, approaching the dipper, and licking the dipper.)

Of course, you might also do shaping as part of this lever-press training. For example, like the rest of us, Rudolph will do no more work than the absolute minimum, and if you let him, he'll just make a wimpy little lever press, barely brushing it with one paw, if that's all it takes to produce the reinforcing drop of water. But we've found that our later experiments don't work too well with such wimpy responding; we've found it works much better to require a truly awesome lever press, a two-pawed job that comes down with such force the whole Skinner box shakes and people in neighboring counties complain about the noise. Of course, to get such righteous performance, we must shape the response, gradually increasing the force requirement, until he's rattling his cage.

So we should reserve the term *shaping* for procedures where we use a series of differential reinforcement procedures for the same response class (like pressing down the lever), one where we gradually change the requirements along some response dimension (like force of the lever press). We should use the terminology *chaining* or *training a behavioral chain* when we are working with a sequence of distinctly different responses (like approaching and then pressing the lever).

Therefore, when you give original examples of shaping,

- make sure you're dealing with only a single response class (not a chain of distinctly different responses)
- and gradually changing the requirements along some response dimension.

Compare and Contrast Shaping vs. Behavioral Response Chaining

	Shaping	Chaining
Several distinctly different responses (response classes)	No	Yes
Behavior changes along a single response dimension (e.g., force)	Yes	No
Skinner box example	Increasing the force of the lever press	Walking toward the lever, pressing the lever, approaching the dipper

QUESTION

1. Explain why it's often wrong to talk about *shaping* the lever press, and explain how *shaping* can be involved in lever-press training.

Sid's Seminar

Tom: I don't understand how shaping is different from behavioral chaining. I mean, the Skinner box example is clear, but I don't think you can make that distinction with human beings.

Sid: Tom, I'm glad you raised that issue. I've got a good demonstration that we can do with human beings. Tom, you be the subject, and who would like to shape his behavior?

Eve: Oh, I can't pass up an opportunity like this. I'll do it.

Sid: OK. Here's what we'll do. Tom will leave the room and the class will think of a response we want to shape. When Tom comes back in, Eve will reinforce each of his successive approximations to that response by tapping on her desk. We will assume that the sound of her tapping on her desk is a reinforcer for the purpose of this exercise. OK?

Tom and Eve: OK.

(Tom leaves the room.)

Sid: Now, what response would we like to shape?

Joe: I think we should make it complex. Like having him walk to a desk and sit down.

Eve: But Joe, that is a behavioral chain. Walking to the desk and sitting down involves two different response classes.

Joe: Oh, yeah; well, what behavior do you want to shape?

Eve: How about raising his left arm? The successive approximations will be part of the same response class.

Sid: Sounds good to me. I'll get Tom.

Tom reenters and walks to the center of the room. As he walks, he swings his arms slightly and Eve taps her desk. Tom repeats his movements in an exaggerated way lifting his left arm and his right arm higher. Eve taps again. Tom stands in one place and swings his right leg as high as he can. Nothing. Then he lifts his arm higher. Eve taps. He raises his left arm all the way up, and Eve taps again as the class claps and cheers.

Eve: Very good, Tom. We were shaping a left-arm raise.

Tom: You shaped my successive approximations to a left-arm raise. I see that now. But what would behavioral chaining have looked like?

Joe: I can answer that; I made that mistake myself. When we shaped successive approximations to exaggerated arm swings, each approximation was a subtle variation of the previous one, just a little more exaggerated. But, we would have reinforced a behavioral chain if, instead, we had reinforced several responses from completely different response classes—like walking to a chair would be one response, X2 turning around would be a completely different response, and then sitting down would be completely different from the first two responses. And sitting down is not just a subtle variant of turning around; it's completely different. But we could chain those three separate responses into one sequence of behaviors, which we call a *behavioral chain*.

Tom: Cool, I see the difference now. I guess the distinction between shaping and behavioral chaining does apply to human beings as well.

QUESTION

1. Show the difference between shaping and behavioral chaining with a human student example.

Notes

1 Based on Isaacs, W., Thomas, J., & Goldiamond, I. (1960). Application of operant conditioning to reinstate verbal

behavior in psychotics. *Journal of Speech and Hearing Disorders*, *25*, 8–15.

2 Based on Wolf, M., Risley, T., & Mees, H. (1964). Application of operant conditioning procedures to the behavior problems of an autistic child. *Behavior Research and Therapy*, *1*, 305–312.

3 Based on Bangs, J. L., & Friedinger, A. (1949). Diagnosis and treatment of a case of hysterical aphonia in a thirteen-year-old girl. *Journal of Speech and Hearing Disorders*, *14*, 312–317.

4 Based on Skinner, B. F. (1938). *The behavior of organisms* (pp. 310–311). Acton, MA: Copley Publishing Group.

CHAPTER 19

Behavioral Chains

Behavior Analyst Certification Board 5th Edition Task List Items

G-8.	Use chaining.	Throughout

Example

BEHAVIORAL MEDICINE

Nancy, A Child With Cerebral Palsy[1]

Nancy was a 5-year-old charmer, with long, blonde hair and blue eyes. She was wearing a blue dress edged with white lace at the collar, wrists, and hem; white tights; and black patent-leather shoes. She was the sort of child who made you wish you had your camera as she ran across the neat, green lawn, laughing and blowing bubbles in the air. She was the sort of child whom you'd expect to find standing next to a white picket fence lined with tulips, a white country cottage in the background, with the sun of a balmy May afternoon brightening the scene.

But she had never run across any lawn, and she had never stood next to any white picket fence. In fact, in her 5 years of life, she had never run or even stood. And somehow, her cute-as-a-button blue-and-white outfit wasn't right. Everything was slightly out of kilter, and her white tights were dirty.

Nancy had cerebral palsy, and her physician said she would never walk, in spite of her surgery. But he had recommended that Dr. Dawn Baker look at the child, just in case behavior analysis had something to offer her. So Dawn did look at Nancy. And she saw the legs frail from lack of use, hidden in the dirty white tights. She saw Nancy as the child scooted across the floor when her mother called her to come and meet the psychologist. Dawn hid her sadness at this sight with a smile and a caress of Nancy's cheek. And Dawn desperately hoped behavior analysis did have something to offer the child.

Intervention

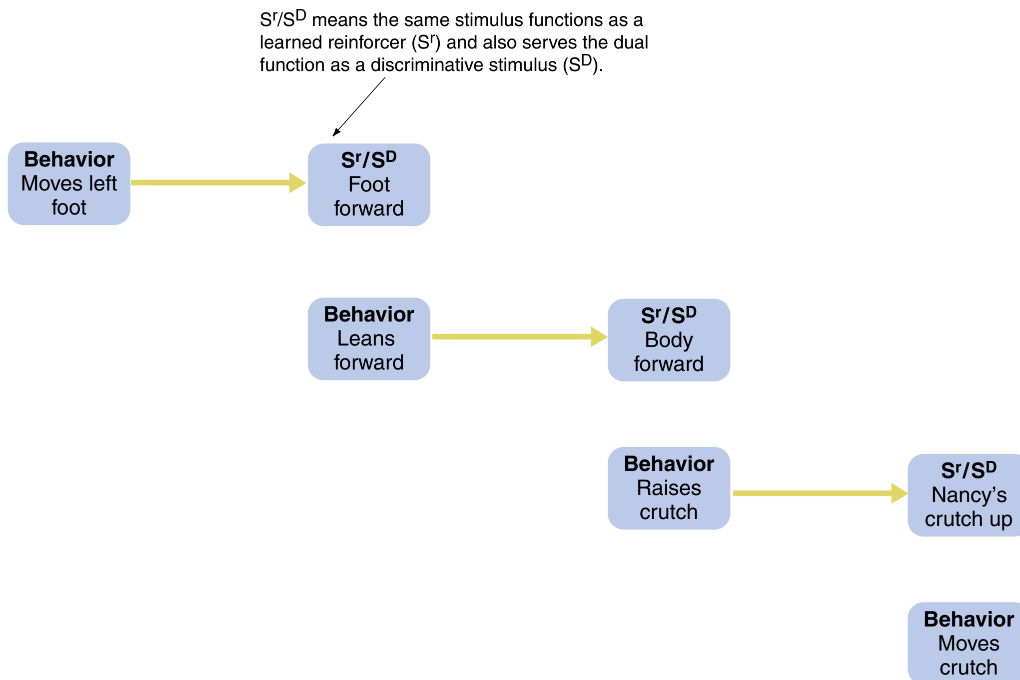
The first thing Dawn did was a task analysis—an analysis of the components of walking. First, Nancy had to rise to her knees. Then she had to rise to her feet. And finally she had to walk with a crutch. These were the main components of the chain of behaviors Nancy would have to perform.

We call such a sequence of responses a ***behavioral chain*** (some call it a ***stimulus-response chain***). Nancy starts by sitting on the floor, and that position is a discriminative stimulus (S^D) in the presence of which making the response of rising to her knees will be reinforced by success. Being on her knees is an S^D in the presence of which making the response of rising to her feet will be reinforced by success. And finally, standing is an S^D in the presence of which making the response of walking with a crutch will be reinforced.

Although a baseline evaluation showed that Nancy had never stood or walked, she did rise to her knees from time to time. So Dawn began by reinforcing Nancy's rising to her knees. On all such occasions, Dawn gave her lavish praise, an occasional spoonful of ice cream, or a chance to play marbles for a few minutes.

After Nancy was reliably rising to her knees, Dawn gave her the ice-cream reinforcer only when she pulled herself to her feet while holding onto a cabinet. Then Dawn raised the criterion again: Nancy had to rise to her knees, pull herself to her feet, and then walk a few steps holding onto the cabinet, before she got the ice cream.

Next, Dawn replaced the cabinet with a harness that she held to give Nancy support while she walked. Gradually, Dawn



reduced the support she gave Nancy and at the same time required her to walk farther and farther before getting the ice-cream reinforcer.

At one point, Nancy was walking while only holding onto Dawn's index finger. Then it was a 12-inch stick with Nancy on one end and Dawn on the other. Next, two wooden handles connected by a spring. Then Nancy was walking with a crutch that Dawn helped to move. Eventually Nancy earned her ice cream and marbles by walking across the room with no help from Dawn.

Now the little girl who would never walk was walking!

But that wasn't enough. Dawn had to reduce the added reinforcers. First, she stopped using the ice cream and marbles. Then she reduced the frequency of her praise. Finally, the normal reinforcers that reinforce our walking were maintaining Nancy's walking—the reinforcers that normally result from getting where we want to go. But because walking took so much more effort for Nancy than for us, Dawn asked her parents to give some social reinforcement now and then.

Also, Nancy's parents had to extinguish completely Nancy's well-established response of scooting across the floor; they had to make sure she got the normal physical and social reinforcers she was going for only if she walked toward them, not if she scooted. In other words, they had to make sure that they and the environment differentially reinforced walking and not scooting.

How long did it take Dawn to train the behavioral chain of Nancy's rising to her knees, then to her feet, and to walk with a crutch? One week? Two weeks? No, 60 weeks with four 30-minute sessions per week—a total of 240 sessions. Of course, if Dawn were to do it again, she'd be able to reduce the time; but it would always be a big deal. It was hard work, but if Dawn and the others who developed these techniques hadn't done the hard work, Nancy would never have been able to walk.*

If you are going to accomplish much of significance, you have to be passionate. You have to be passionate about improving the well-being of humanity, you have to be passionate about helping people, you have to be passionate about saving the world with behavior analysis. You have to be passionately dedicated and have an almost unreasonable amount of faith in behavior analysis, if you're going to work with a little girl like Nancy for 60 weeks so that she can walk and lead a life with greater happiness and dignity. Slackers need not apply.

* In Chapter 18, we talked about shaping vs. getting in shape. In the present case, it might be a little of both. Nancy could rise to her knees on her own; so increasing that behavior was probably just shaping. But as they worked on increasing the distance and independence of walking, getting in shape also probably played a role.

QUESTION

1. Diagram a behavioral intervention to teach a child with cerebral palsy to walk.

Concept

BEHAVIORAL CHAINS (G-8)

So far, we've seen one behavioral chain—Nancy's rising to her knees, then to her feet, and finally walking. We could analyze her walking into a more detailed chain, as Dawn, in fact, had to do. Walking is so easy and natural for us, we ignore that it's really a complex behavioral chain, especially if you add a crutch. Here we go: left foot forward, lean forward, raise crutch, move crutch forward, put crutch down, right foot forward, straighten up, right foot down—and then you start the whole behavioral chain again, each separate response putting you in a new position that acts as an S^D for the next response.

Our life is full of behavioral chains: The sight of mashed potatoes on our plate is followed by our picking up the fork (operandum). The fork in our hand allows us to put it into the potatoes. The fork in the potatoes is an S^D for raising the fork. The raised, potato-laden fork is an S^D for putting the fork in our mouth, and so on. We close our mouth, pull the fork out, chew the potatoes, swallow them, and get our fork ready for the next round—each response producing a stimulus and followed by the next response.

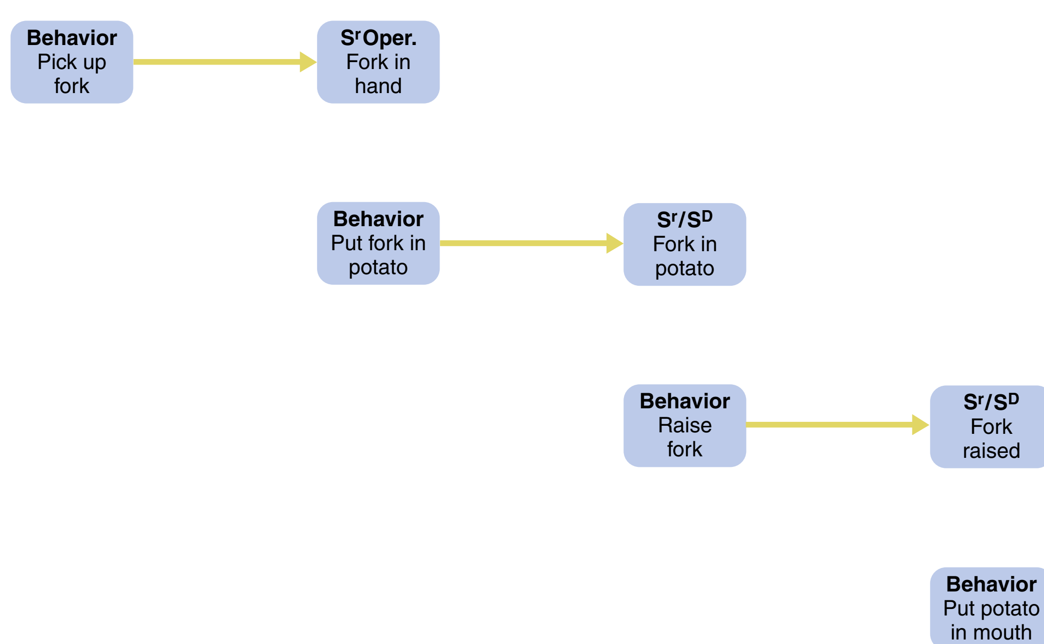
Definition: CONCEPT

Behavioral chain

- A sequence of stimuli and responses.
- Each response produces a stimulus that
- reinforces the preceding response
- and is an S^D or operandum
- for the following response.

Traditionally, we think of a response within a chain as producing an outcome that is a reinforcer for that response and an S^D for the next response. But what about the standard Skinner box behavioral chain? Rudolph touches a dot on the wall with his nose. The outcome of that response is a chain is lowered into the Skinner box. Rudolph pulls the chain. The outcome of the chain pull is that a light is turned on and Rudolph presses the lever. The outcome is a drop of water. Now, at first glance, we might think that the chain being lowered into the Skinner box is an S^D, but it isn't. The chain is an operandum like the lever in the Skinner box. The chain isn't the opportunity for a response to be reinforced (the S^D); it's the opportunity for the response to be made (the operandum); Rudolph can't pull the chain if it ain't there.*

* A tip of the hat to Brad Frieswyk for suggesting the inclusion of operandum in our definition of behavioral chain. He raised this issue in our graduate seminar on the principles of behavior in August 1993.



In the same way, the fork in our hand may be more of an operandum, like Rudolph's lever, than an S^D. We must have the fork in our hand before we can put it in the potatoes.

QUESTION

1. *Behavioral chain*—define it and diagram a dining-table example.

Principle

DUAL-FUNCTIONING CHAINED STIMULI

As we mentioned, a traditional and useful analysis of behavioral chains is that the stimulus resulting from one response actually serves two functions: It acts as an S^D for the next response, and it acts as a conditioned reinforcer for the response that produced it. (Of course, the reinforcer at the end of the final link in the chain will often be an unconditioned reinforcer and may not serve as an S^D.)

Let's look at our potato-eating example again; this time we'll emphasize the ***dual functioning*** of the stimuli:

- The sight of the potatoes is a stimulus in the presence of which we pick up our fork.*
- The sight and feel of the fork in hand reinforced picking it up. (If you'd tried to pick up the fork and it kept slipping from your hand, trying to pick it up wouldn't be reinforced.)
- But at the same time, the sight and feel of the fork in hand also functions as an S^D in the presence of which moving your hand near the potatoes will be reinforced. (Moving an empty hand near the potatoes either won't be reinforced or will be a little messier than you might like—we're talking soupy mashed potatoes here, not crisp French fries.)
- The sight and feel of the fork in the potatoes reinforced moving the fork toward the potatoes. (If someone kept pulling the potatoes away from you as you approached them, we'd be talking extinction city, not to mention frustration city.)
- At the same time, the fork full of mashed potatoes is an S^D for raising it to your mouth.
- So dining illustrates that a stimulus in a behavioral chain can function at the same time both as a conditioned reinforcer and as an S^D. It functions as a conditioned reinforcer for the response that produces it and as an S^D for the next response in the chain.

Definition: PRINCIPLE

Dual-functioning chained stimuli

- A stimulus in a behavioral chain
- reinforces the response that precedes it
- and is an S^D or operandum for the following response.**

* The analysis of the role of the sight of the potatoes is so complex that we're burying it in this footnote. In the 3rd edition of this book, we said the sight of the potatoes was an S^D, in the presence of which picking up the fork would be reinforced. But a student in one of my seminars pointed out that this was too superficial. What's the reinforcer for picking up the fork? As we show in the diagram, the reinforcer is having the fork in your hand. Does that mean if you can't see the potatoes (S^D) and you pick up the fork, that you won't have it in your hand? Of course not. So, because there's no S^Δ, there's also no S^D.

Then what is the sight of the potatoes, if not an S^D? It's a motivating operation (a.k.a. establishing operation)! But to appreciate this we need to look at the more detailed definition of motivating operation that Michael provides: A motivating operation is an environmental event, operation, or stimulus condition that affects an organism by momentarily altering (a) the reinforcing effectiveness of other events and (b) the frequency of occurrence of the type of behavior that had been consequated by those other events (Michael, J. [1993]. Establishing operations. *The Behavior Analyst*, *16*, 191–206). So what does that have to do with sight of potatoes? The sight of the potatoes is a stimulus that increases the reinforcing effectiveness of having the fork in your hand. In the absence of the sight of the potatoes or some other delicious forkable, having the fork in your hand won't be a reinforcer.

Having said all that, of course there is an S^D for picking up the fork, and that's the sight of the fork itself. The sight of the fork is an S^D for the behavior of reaching out and grasping. In the presence of the sight of the fork, reaching out and grasping has a consequence of having the fork in the hand. The S^D does not make the fork in hand reinforcing. Of course, this isn't completely compatible with our definition of S^D, but please cut us a little slack. Otherwise we'll have a whole chapter of these convoluted footnotes.

** For two reasons, we've stated a separate principle of dual-functioning chained stimuli, rather than place this notion within the definition of the behavioral chain. First, it is logically possible to have a behavioral chain without those stimuli functioning both as S^Ds or operanda and as reinforcers (e.g., all but the last stimulus might function as S^Ds, and the last stimulus might be the reinforcer that keeps the whole chain going with no support from conditioned reinforcers embedded in the chain). And second, a separate treatment of this notion of duality of function might reduce the confusion students often experience when reading about behavioral chaining.

Your hand on the key in the ignition of your car is an S^D for turning that key. The running of your car's engine reinforces turning the key and also acts as an S^D for putting the car in gear. So your car's starting illustrates the principle of **dual-functioning chained stimuli**.

QUESTION

1. The principle of *dual-functioning chained stimuli*—define it and give an example.

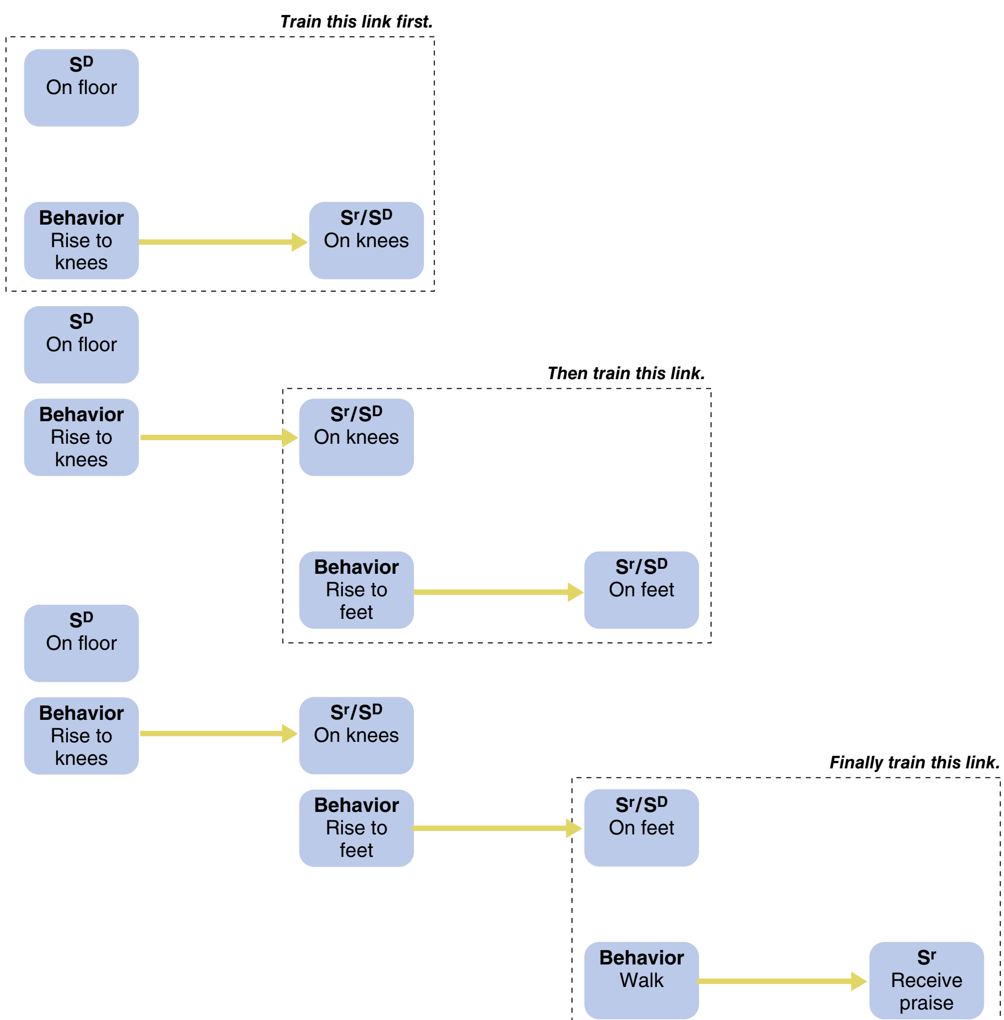
Concept

FORWARD CHAINING

The most obvious way to establish a chain is through **forward chaining**. Dawn did that with Nancy. She started with the first link in the chain—Nancy's rising to her knees—and established that link. Then she added the next—Nancy's rising to her feet. And finally, she added the terminal link—Nancy's walking. Establishing that chain went forward from the initial link to the terminal link. (Check out the following diagram.)

Kurt Mahoney, Keith Wagenen, and Lee Meyerson also used forward chaining to toilet train children with and without intellectual disabilities. First they reinforced the initial response in the behavioral chain: When the child walked to the toilet, the trainer would give her a bite to eat and would clap his hands and say, "Good girl!"—an added reinforcement contingency. Then the trainer added the next link, lowering the pants, which also produced those added reinforcers. After the child had acquired the first two links, the trainer added sitting on or facing the toilet (as appropriate). Then eliminating and, finally, pulling up the pants. This was forward chaining because the trainer started

Forward Chaining



with the initial link (walking to the toilet) and progressed link by link to the terminal link (pulling up the pants).[2]

Of course the trainers and parents eventually stopped using the added reinforcement contingencies involving food and praise. Then the chain was on its own. The stimuli resulting from each of the successive responses in the chain served as the reinforcer for the preceding response and the S^D for the next, thus illustrating the principle of dual-functioning chained stimuli. For example, the sight of the toilet reinforced approaching it and acted as an S^D for pulling down the pants. By the way, this behavioral approach to toilet training produced excellent results for both typical children and those with mental disabilities.

Definition: CONCEPT

Forward chaining

- The establishment of the first link in a behavioral chain,
- with the addition of successive links,
- until the final link is acquired.

Philip Wilson and his colleagues used forward chaining to help clients with profound intellectual disabilities acquire a repertoire of family-style dining. Their task analysis indicated three major sequences in the chain, with several links of the behavioral chain in each major sequence. For example, the premeal sequence included going to the preparation table, picking up a spoon and a fork, and so on. The meal sequence included grasping the serving bowl with both hands, picking it up, and placing it in the neighbor's hands or within 6 inches of the neighbor's plate. The post-meal sequence included standing up, picking up the plate, and carrying the plate to the preparation table. In total, the chains contained 30 links.[3]

They used forward chaining in this way: They started with the first link in the premeal chain: going to the preparation table. When the client had mastered one link, the trainer added the next one—for example, picking up the spoon and fork.

The trainer used various levels of prompts. The strongest prompt was physical guidance. The next level consisted of a model demonstrating the link in the chain (picking up the spoon and fork). The next level consisted of verbal instructions ("John, pick up the spoon and fork"). Ultimately, the prompts were faded out so that the stimuli arising from the preceding response in the chain functioned as an effective S^D for the next response (the sight of the preparation table that resulted from going to it was an S^D for picking up the spoon and fork).

However, when Philip and his colleagues were first establishing the chain, the natural or built-in results of the responses were not strong enough to function as reinforcers and were not acting as S^Ds. That's why they first had to use the prompts and added reinforcement contingencies.

Praise and small snacks served to reinforce the performance of the various links, as the clients acquired the total behavioral chain. A major sequence of links required an average of thirty 6-minute sessions. So we could expect that it would take about 9 hours of training for a client with profound intellectual disabilities to acquire a repertoire of family-style dining—much work, but worth it, at least in the opinion of the direct care staff who were responsible for these clients. This is in keeping with the considerable effort being made to help people with intellectual disabilities live lives as close to normal as possible.

QUESTION

1. *Forward chaining*—define it and diagram its use to teach walking to a child with cerebral palsy.

Concept

TOTAL-TASK PRESENTATION[4]

Don Horner and Ingo Keilitz used a variation of forward chaining called **total-task presentation** to help adolescents with intellectual disabilities acquire tooth-brushing skills. First they did a task analysis of the behavioral chain of tooth brushing, breaking the chain into 15 components. The chain went from picking up and holding the toothbrush through wetting the toothbrush, removing the cap from the toothpaste tube, and brushing the various surfaces of the teeth to finally putting away the equipment.

Unlike the method of forward chaining, with total-task presentation the learner performed each of the 15 links of the chain before starting over again. In other words, the learner didn't have to master one link before proceeding to the next. Instead, this procedure was used: The trainer would tell the student to do the response in one of the links. If that didn't work, the trainer would model that response and give verbal instructions. If even that didn't work, the trainer would use physical guidance along with instructions. Then they'd move on to the next link in the tooth-brushing chain and repeat those steps. The trainer praised the client each time he or she completed a response in a link of the chain (e.g., removed the cap from the tube).

Suppose they start through the behavioral chain and they reach the point where the client must unscrew the cap from the toothpaste tube. Suppose the client isn't able to do this, so the trainer takes the client's hands and guides him through the process of unscrewing the cap until it is completely unscrewed. Then they move on to the next step—putting the toothpaste on the brush. Notice that the client still hasn't mastered the response of unscrewing the cap. He will still need some, though less, guidance the next time they go through the total chain. So the case may arise where the client masters steps out of order (masters steps 3, 7, 12, and 13, but still needs work on the other steps).

Definition: CONCEPT

Total-task presentation

- The simultaneous training of
- all links in a behavioral chain.

The clients all acquired the tooth-brushing repertoire, usually within 30 daily sessions. (They went through the behavioral chain once a day.)*

QUESTION

1. *Total-task presentation*—define it and give two examples. Describe:
   - the response classes
   - the reinforcement contingencies
   - the presumed reinforcers
   - the results
   - any other interesting features of the intervention

Concept

BACKWARD CHAINING

Backward chaining is the third major way of establishing behavioral chains. Instead of starting by establishing the first link of the chain, then the second, and so on, backward chaining goes in the opposite direction. You establish the last link first, then the next to the last, and so on.

Definition: CONCEPT

Backward chaining

- The establishment of the final link in a behavioral chain,
- with the addition of preceding links
- until the first link is acquired.

Example of Backward Chaining

GETTING DRESSED

We don't spend much time thinking about everyday tasks such as how to get dressed unless we must help someone who has not learned how. Suppose you have to teach a man with intellectual disabilities how to dress himself. What normally seemed so simple and matter-of-fact is now difficult and complex. The act of putting on a pair of trousers now becomes a major undertaking that we can best analyze in terms of a behavioral chain. And we can help the man acquire that repertoire using backward chaining.[5]

In using backward chaining, we would start with the final link and work backwards. This means we would put the trousers on the man and pull them almost all the way up. We might even place his hands on the top of his pants and then provide him with the discriminative stimulus, "Pull up your trousers." We should reinforce this response with either a conditioned reinforcer, such as praise, or an unconditioned reinforcer, such as candy. This simple response in itself might even require some shaping. We are then ready for the next component in the chain. This consists of leaving the trousers down near the knees and providing the discriminative stimulus, "Pull up your trousers." The next component of the chain may consist of pulling the trousers from just above the ankles, and then going through the standard procedure. Eventually, we can simply place the trousers in front of the man and give the instructions, "Put on your trousers."

Example of Backward Chaining

JIMMY, THE CHILD WITH AUTISM—PART XVII

Eating With a Spoon

When Jimmy came to the Rosa Parks Academy, he could not feed himself or even grasp or hold a spoon. Here's how Max used backward chaining to help Jimmy learn to eat with

* How does a behavior analyst, teacher, or skills trainer determine whether to use total-task presentation or some other form of behavioral chaining? The lower the skills of the client and the longer the chain, the more likely we'd use backward or forward chaining.

a spoon. He started by filling the spoon with applesauce (a highly reinforcing food for Jimmy), placed the spoon in Jimmy's hand, and raised Jimmy's hand to his mouth. And for the most part, Jimmy sat there passively while Max helped him go through the motions.

After several trials with that physical guidance, Max removed his hand and required Jimmy to complete the rest of the chain by placing the food in his mouth. When this response was established, Max released Jimmy's hand farther away from his mouth. After a few more trials, Max needed only to help Jimmy fill the spoon, and Jimmy soon mastered this final component.

We can establish many behavioral chains of this sort, useful behavioral chains that people with intellectual and developmental disabilities often lack. We would often do this using backward chaining and patience. Efforts from dedicated behavior analysts help such people go through life with more dignity than would otherwise be possible. We can also use backward chaining in training most children, especially in basic self-care skills.

QUESTION

1. *Backward chaining*—define it and give two examples. Describe:
   - the response classes
   - the reinforcement contingencies
   - the presumed reinforcers
   - the results
   - any other interesting features of the intervention

In the Skinner Box

BACKWARD CHAINING

Here's the behavioral chain we want Rudolph the Rat to perform. First, he pulls a chain hanging from the ceiling, which turns on a light; then he presses the lever, which causes the dipper to dip down and bring up a drop of water, making a slight click, as it returns; then he drinks the water; and you turn the light off, ready for a new trial.

Rat pulls chain → Light on → Rat presses lever → Dipper click → Rat approaches dipper → Receives water

We usually use backward chaining when we establish behavioral chains in nonverbal animals. How would you do that with this example?

If this were Rudolph's first time in the Skinner box, you'd start with dipper training. That means you'd establish the click of the dipper as an S^D for approaching the dipper. Easy. Whenever Rudolph is moving around (not just hovering over the dipper), you'd dip the dipper into the water and bring it up with an audible click.

Dipper click → Rat approaches dipper → Receives water

The click is an S^D, because approaching the dipper is reinforced by the drop of water after a click but not at other times (silence is the S^Δ).

Once you've dipper-trained Rudolph, move one step backward in the behavioral chain. You'd reinforce lever pressing with the light on (S^D). And you'd extinguish lever pressing when the light's off (S^Δ). Presumably the dipper-click would have a dual function; it would now function as a reinforcer for pressing the lever, as well as an S^D for approaching the dipper.

Light on → Rat presses lever → Dipper click → Rat approaches dipper → Receives water

Then you'd move another link back in the chain. You'd reinforce chain pulling, using the onset of the light as the reinforcer.

Rat pulls chain → Light on → Rat presses lever → Dipper click → Rat approaches dipper → Receives water

So now, the light would be showing dual functionality, functioning as a reinforcer for chain pulling, as well as an S^D for lever pressing.

Once you've finished with Rudolph's training, he should be able to run through several of those behavioral chains each minute. And you'll have found the whole experience almost as reinforcing as Rudolph did.

Behavior analysts first developed the procedure of backward chaining in the Skinner box with rats. And you can see why: Suppose you tried forward chaining. If you click the water dipper after each new component that you add in forward chaining, then the rat would develop the little sequence, or chain, of doing the first link and then going to the water dipper.

Rat pulls chain → Dipper click → Rat approaches dipper → Receives water

Now you want to insert the lever press

Rat pulls chain → Rat presses lever → Dipper click → Rat approaches dipper → Receives water

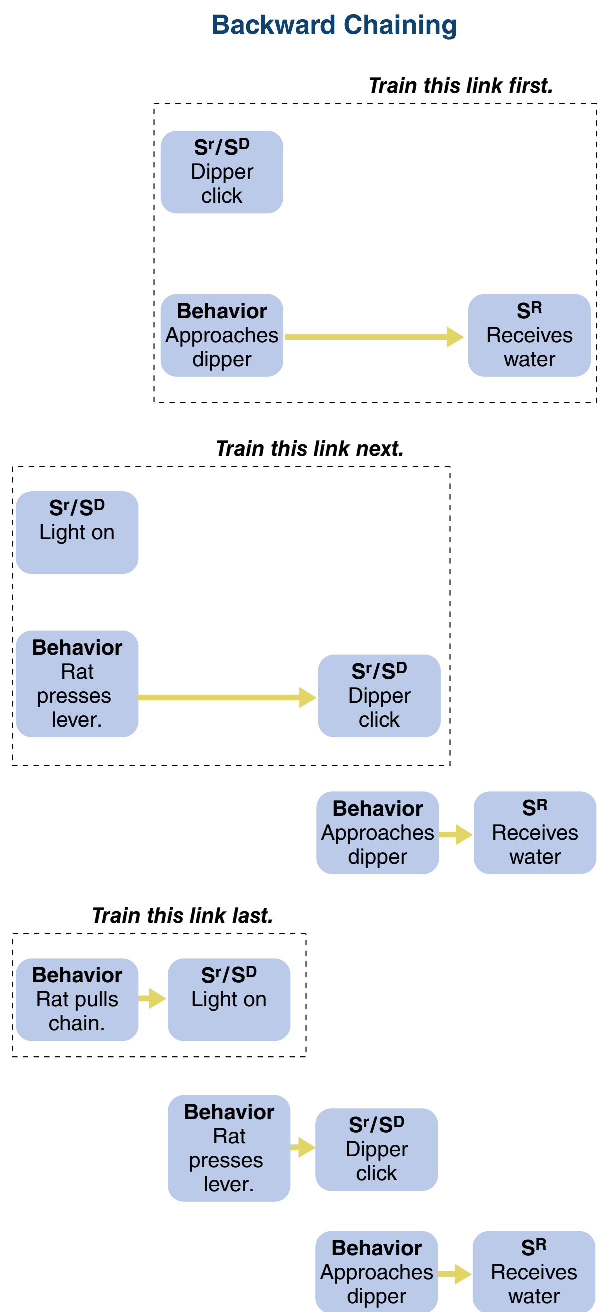
But before you could add the lever-press link, you'd have to extinguish the chain-pull link that you and Rudolph had just worked so hard to train.

Rat pulls chain → No dipper click

You and Rudolph would have a complete mess rather than a reinforcing experience.

But we might not have so many problems using forward chaining when the learner gets the reinforcer without having to interrupt the sequence by running over to the water dipper. For example, we might be able to train a child to put on his trousers using forward chaining and simply say "Good boy" after the completion of each link of the chain, adding a new link as the child mastered earlier links. We applied behavior analysts, working with verbal human beings, may have been too literal in our adoption of the specific technique of backward chaining from the animal laboratory. However, with animals and nonverbal human beings, backward chaining might still be our best choice.

By the way, note that there's no S^D for the chain-pull response. Light off is the before condition and light on is the after condition. Whenever the light's off, pulling the chain will turn it back on. Remember that to have an S^D we must also have an S^Δ. We'd have an S^D if the only time the chain pull turned the light on was when there was a buzzer buzzing. Then the buzzer would be the S^D and the absence of the buzzer would be the S^Δ. Remember that test. Without an S^Δ you don't have an S^D.



Also, note that we usually think of a behavioral chain as consisting of the one-and-only way of getting from the first link to the last; for example, you have to put your feet in your trousers before you can pull them up to your waist, and you should pull them up to your waist, before you zip and button them. But suppose you're training people to set the dinner table; whether they put down the fork before or after they put down the spoon is arbitrary, though it might be good to establish a chain where one always occurs before the other, especially if you're training a fairly disabled person. Another way to put it is that, for most chains we discuss, each response is a prerequisite for the next one, but that's not the case when the sequence is arbitrary.

QUESTION

1. Diagram the use of backward chaining in the Skinner box.

In the Skinner Box

DUAL-FUNCTIONING CHAINED STIMULI

Let's take another look at Rudolph's behavioral chain, this time in terms of the dual-functioning stimuli. It's just a series of connected contingency diagrams of the sort we've been using all semester. Here the *after condition* is a dual-functioning stimulus; it functions both as the conditioned reinforcer for the preceding response in that diagram and the S^D for the next response in the diagram below it.

In the case of the chain-pull response, don't make the mistake of confusing the before condition (light off) with the S^D (there is none, and light off is *not* the S^D for the chain pull). (Check out the Dual-Functioning Chained Stimuli diagram.)

QUESTION

1. Diagram dual-functioning chained stimuli in the Skinner box.

NON-CHAINED BEHAVIOR SEQUENCES

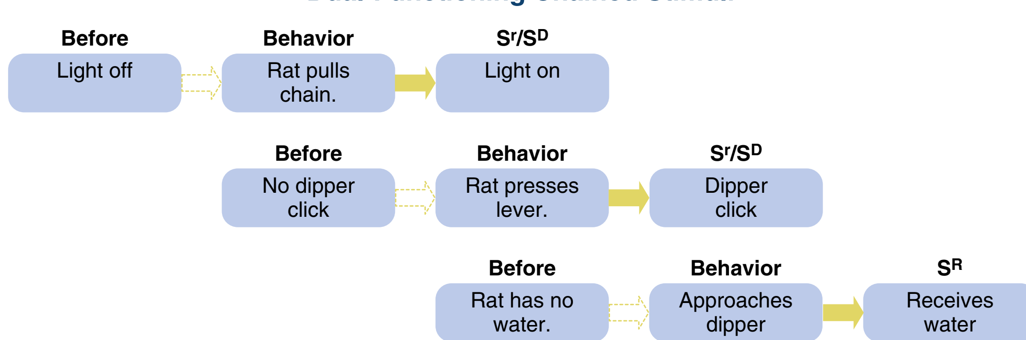
Usually, behavior analysts deal with behavioral sequences as behavioral chains (stimulus-response chains—a series of links in which each response produces the stimulus or operandum for the next response). But some behavioral sequences don't seem to work that way. Consider typing the word *the*: Typing *the* may start as a stimulus-response chain, and to make our point, we're going to look at some of the neural links between stimuli and responses in such a chain.

S^D (see or hear or think the word *the*) → nerve impulse to the muscles involved in typing *t* → Type *t* → nerve impulse from the muscles involved in typing *t* → proprioceptive receptors → S^D (feeling of having just typed *t*) → nerve impulse to the muscles involved in typing *h* → Type *h* → nerve impulse from the muscles involved in typing *h* → proprioceptive receptors → S^D (feeling of having just typed *h*) → nerve impulse to the muscles involved in typing *e* → Type *e*

But it takes time for each of those nerve impulses to travel from the muscles to the receptors and from the receptors to the next set of muscles, more time than it takes for a skilled typist to type *the*. In other words, as the typist gets more skilled, the sequence becomes too fast to be a chain of sequential neural impulses and typing responses. By the time skilled typists get the proprioceptive stimuli from typing the *t*, they've already typed *h*—the news is too late to have been of any help. Skilled typists type the letters too fast for us to describe that behavioral sequence as a behavioral chain. Skilled typists would already have shut their computer off and faced the rush-hour traffic heading home before all those neural impulses would have had time to catch up if they were typing a long manuscript.

Perhaps we can best describe that process as follows: The word *the* is an S^D for the three separate typing responses, typing *t*, *h*, and *e*. But it's an S^D for typing *t* with a short latency (very quickly), typing *h* with an intermediate latency (not as quickly), and typing *e* with a longer latency (even more slowly). Therefore, at the sight or sound or thought of the word *the*, skilled typists start typing all three letters at the same time, but with slightly different latencies.[6]

Dual-Functioning Chained Stimuli



S^D (see or hear or think the word *the*) ===> nerve impulse to the muscles involved in typing *t* → Type *t* ========> nerve impulse to the muscles involved in typing *h* → Type *h* =============> nerve impulse to the muscles involved in typing *e* → Type *e*

Of course, we intermediate-level typists sometimes mess up the latencies with a resulting *teh*.

QUESTION

1. Give an example of a non-chained behavioral sequence.

Notes

1 Based on O'Neil, S. (1972). The application and methodological implications of behavior modification in nursing research. In M. Batey (Ed.), *Communicating nursing research: The many sources of nursing knowledge*. Boulder, CO: WICHE.

2 Based on Mahoney, K., Van Wagenen, K., & Meyerson, L. (1971). Toilet training of normal and retarded children. *Journal of Applied Behavior Analysis*, *4*, 173–181.

3 Based on Wilson, P. G., Reid, D. H., Phillips, J. F., & Burgio, L. D. (1984). Normalization of institutional mealtimes for profoundly retarded persons: Effects and noneffects of teaching family-style dining. *Journal of Applied Behavior Analysis*, *17*, 189–201.

4 Based on Horner, R. D., & Keilitz, I. (1975). Training mentally retarded adolescents to brush their teeth. *Journal of Applied Behavior Analysis, 8,* 301–309; Cooper, J. O., Heron, T. E., & Heward, W. L. (1987). *Applied Behavior Analysis* (p. 353). Columbus, OH: Merrill.

5 Based on Breland, M. (1965). *Foundation of teaching by positive reinforcement* (pp. 127–141). Atlanta: Southern Regional Education Board; Caldwell, C. (1965). Teaching in the cottage setting. In G. J. Bensberg (Ed.), *Teaching the mentally retarded* (pp. 159–163). Atlanta: Southern Regional Education Board.

6 The latency, or reaction-time, argument may no longer be as tenable as it once seemed, but for a more detailed, though more cognitive, argument in support of non-chained behavioral sequences (traditionally called *motor programs*), see Mazur, J. E. (1998). *Learning and behavior* (4th ed., pp. 329–333). Upper Saddle River, NJ: Prentice Hall. Also, see Catania, A. C. (1998). *Learning* (4th ed., pp. 124–126). Upper Saddle River, NJ: Prentice Hall.

PART XI

Schedules of Reinforcement

CHAPTER 20

Ratio Schedules

Behavior Analyst Certification Board 5th Edition Task List Items		
B-5.	Define and provide examples of schedules of reinforcement.	Throughout
C-10.	Graph data to communicate relevant quantitative relations (e.g., equal-interval graphs, bar graphs, cumulative records).	Pages 365–366
G-9.	Use discrete-trial, free operant, and naturalistic teaching arrangements.	Pages 369–371

Example

THE DIVERS OF NASSAU

The Nassau dock was crowded with tourists of assorted sizes, shapes, ages, and dispositions, their cameras slung about their necks like gawky identification tags. Here and there, tourists perspired beneath sunglasses, their skin already turning pink under the Bahamian sun. The cruise boats were in from Miami: the *Bahama Star*, the *Miami*, the *Ariadne*, and the *Wayward*. The port bustled with enterprise.

In the harbor, the water was a clear blue. Groups of Bahamian boys stood in a cluster by the wharf. They had planned in advance to stay there. No tourist could land on Bahamian soil without first allowing them an opportunity to solicit tribute.

"Hey, Mon, throw in de coin and watch me bring him up."

An occasional tourist tossed a quarter into the cool waters of the harbor. Almost before the coin had passed the tourist's fingertips, the boys were thrashing about in the water, anxiously watching like cats awaiting a winged sardine. Then in a frantic swirl they disappeared beneath the water in pursuit of the coin gliding on its way through 15 feet of water to the bottom. One by one the divers rose to the surface. Invariably, one would hold the coin high above his head for all to see, the coin glittering in the sun, as its new owner smiled triumphantly.

Fascinated, I watched the Bahamian youngsters for the better part of that afternoon. I noticed one boy in particular. He was smaller than the others and not as adept in underwater recovery. His large brown eyes had reddened from long contact with the saltwater. Twenty, perhaps thirty, times I saw him disappear beneath the water and come to the surface catching his breath, empty-handed. He was growing tired. Finally, when I was all but ready to offer him money if he would not dive again, a tourist threw another coin in the water. I did not see him dive this time. Could he be resting, clinging to a piling beneath the wharf? No, there he was, rising to the surface, his right hand high above his head, a quarter held tightly between his small fingers. He showed his achievement to all; and with renewed vitality, he jumped from the water up to the wharf. When a tourist threw the next coin, he was the first to break the water.

Concept

SCHEDULES OF REINFORCEMENT

The behavior of the young Bahamian shows a feature sometimes seen in everyday life: Success does not always follow every attempt. By success, we mean reinforcement. Taking this into account, behavior analysts have suggested the term *intermittent reinforcement* for instances where reinforcement occurs but not after each response, and they use *continuous reinforcement* (*CRF*) for instances where reinforcement does occur after each response. For example, when you laugh at every single joke your professor makes, you're reinforcing joke telling on a **continuous reinforcement** schedule.

Definition: PROCEDURE

Continuous reinforcement (CRF)

- A reinforcer follows each response.

And if you only laugh at the jokes once in a while, you're reinforcing joke telling on an **intermittent reinforcement** schedule.

Definition: PROCEDURE

Intermittent reinforcement

- Reinforcement schedule in which a reinforcer follows the response only once in a while.

Continuous reinforcement is more explicit than intermittent reinforcement. In other words, knowing that intermittent reinforcement is in effect, we must then ask how often a response produces reinforcement and under what conditions. **Schedule of reinforcement** refers to the specific way reinforcement occurs.

Definition: CONCEPT

Schedule of reinforcement

- The way reinforcement occurs
- because of the number of responses,
- time since reinforcement,
- time between responses,
- and stimulus conditions.

Continuous reinforcement is usually best for shaping or maintaining difficult behavior. Remember Andrew from Chapter 18? After his 19 years of silence, the behavior analyst helped him speak again. She began by reinforcing Andrew's lip movements and continued reinforcing each behavior that more closely approximated normal speech. She reinforced vague vocal sounds, then vocal sounds that resembled a word, and finally speech. The behavior analyst used a continuous reinforcement schedule; in other words, she reinforced each response that met the criterion for reinforcement of that phase of the shaping procedure. If she had used intermittent reinforcement, shaping Andrew's speech would have been difficult or impossible.

QUESTIONS

1. *Intermittent reinforcement*—define it. Then describe how it applies to the behavior of diving for coins.
2. *Continuous reinforcement*—define it and give an everyday example.
3. *Schedule of reinforcement*—define it.
4. What type of schedule of reinforcement is best for shaping behavior? Give an example.

Concept

EXPERIMENTAL ANALYSIS OF BEHAVIOR

Fixed-Ratio Schedules of Reinforcement

Behavior analysts have extensively studied schedules of intermittent reinforcement in the Skinner box. One of the most common is the **fixed-ratio schedule**; for example, Rudolph must press the lever a fixed number of times for each reinforcer.

Definition: PROCEDURE

Fixed-ratio (FR) schedule of reinforcement

- A reinforcer is contingent on
- the last of a fixed number of responses.

With fairly large ratios, say 100 responses per reinforcer, there is usually a consistent pattern of responding—a high rate of responding until the reinforcer is delivered followed by a pause before responding starts again.

Definition: PRINCIPLE

Fixed-ratio pattern of responding

- After a response is reinforced,
- no responding occurs for a period of time,
- then responding occurs at a high, steady rate
- until the next reinforcer is delivered.

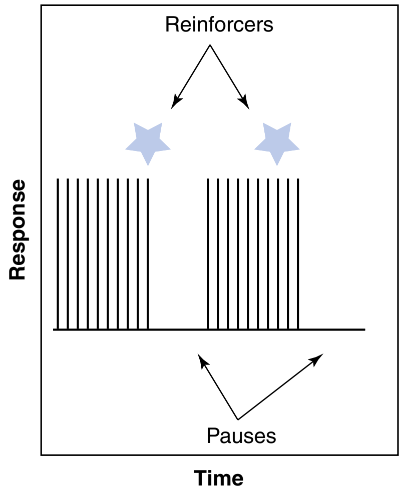


Figure 20.1 Noncumulative Graph

In Figure 20.1, the horizontal line (*x*-axis, or abscissa) indicates the passage of time; each vertical line indicates a response; and at the end of each ratio of eight responses a reinforcer is delivered (indicated by the star). After each reinforcer, the line is flat, indicating that no response occurs for a while. ***Post-reinforcement pause*** is the name of this pause after the consumption of the reinforcer and before the next ratio of responses begins. In reality, a fixed ratio of only eight responses might not produce such a noticeable post-reinforcement pause, at least in a well-trained rat.

The post-reinforcement pause is another characteristic of fixed-ratio-maintained behavior. The length of the pause is proportional to the size of the ratio. If the ratio is large, the pause will be long, and if the ratio is small, the pause will be short. In extremely small fixed-ratio (FR) schedules, the post-reinforcement pause may be so small that you cannot see it.

If you wish to establish a high ratio requirement, you need to do so gradually, raising the ratio from two to four to six responses and on up to higher ratios only after a number of reinforcers have been delivered at each ratio value. Otherwise, responding will extinguish. So we have the ***general rule for establishing intermittently reinforced behavior***: *First use continuous reinforcement and gradually increase the intermittency of reinforcement as responding stabilizes at a high rate*.

The higher the ratio, the more important it is to introduce it gradually through lower initial ratios. If we made the ratio too high too quickly, then the response would extinguish. Extinction due to this procedural error is known as *straining the ratio*.

By gradually increasing the requirement, we can reduce to a minimum the number of reinforcers needed to maintain behavior. Eventually, we can maintain an amazingly high ratio with few reinforcers. Dr. Jack Findley[1] gradually brought a pigeon to respond reliably on an FR 20,000: After 20,000 pecks, the pigeon got several grams of grain. Even though this is more grain than pigeons often get in reinforcement procedures, it does not detract from the pigeon's spending almost all day pecking as fast as it could before getting the reinforcer.

But how could a pigeon count to 20,000? If this is your question, you are suffering from a common misunderstanding about fixed-ratio schedules. Counting is not a requirement for performance of a fixed-ratio schedule. Reinforcement will occur after the pigeon made the required number of responses, regardless of whether the pigeon counted. The effectiveness of the fixed-ratio schedule in no way depends on counting. The bird just pecks away until the reinforcer is delivered.

Because students are sometimes confused about the requirements for an FR schedule, let's lay it out. Assume Rudolph's lever pressing was reinforced on an FR 120. That means that when he pressed the lever once, he'd get no water; the second time—none; on up to the 119th time—none. But that 120th lever press would produce that reinforcing drop of water. Then Rudolph would have to start all over again. And again, his first response would produce nothing, and so on up through his 119th lever press. But the 120th would again produce the reinforcer. What the first 119 responses did was move Rudolph closer to the reinforced 120th response. Now humans and nonhumans alike usually pause after each reinforcer, especially on a large FR. But the FR schedule doesn't require that they do; they might fly through the ratios like a bat out of hell, pausing only long enough to pick up their hard-earned reinforcers. Or they might mosey along at a rate so slow it would put the experimenter to sleep. In any case, as soon as they make their fixed number of responses, they get their reinforcer and are ready to start another ratio.

QUESTIONS

1. *Fixed-ratio schedule of reinforcement*— define it and give a Skinner-box example.
2. *Post-reinforcement pause*—give an example.
3. What is the relationship between the length of a pause and the size of the ratio in a fixed-ratio schedule of reinforcement?
4. How would you build up to a high ratio requirement?
5. What do behavior analysts mean by straining the ratio?
6. For a pigeon to respond on a fixed-ratio 20,000 schedule of reinforcement, does the pigeon have to be able to count the responses? Explain.

Concept

EXPERIMENTAL ANALYSIS OF BEHAVIOR

The Cumulative Graph (C-10)

Another way of plotting the data is in a *cumulative graph* or *cumulative record* (Figure 20.2). Behavior analysts often use this type of graph when studying schedules of reinforcement. Here's a cumulative record of Rudolph's performance on an FR 120.

We labeled the vertical axis *cumulative frequency of responses*, as opposed to a noncumulative graph, in which we labeled the ordinate simply *responses*. The labeling of the horizontal axis for both figures is identical.

In the cumulative record, you can see that Rudolph made the first response and kept pressing as rapidly as he could until he had completed the ratio requirement and gotten his reinforcer. You also can see the post-reinforcement pause, where the slope of the line is 0 or horizontal, indicating no responding for a little while before Rudolph starts responding again. Behavior analysts use both noncumulative and cumulative graphs in describing behavior and behavioral change.

QUESTION

1. Draw both a cumulative and a noncumulative frequency graph.

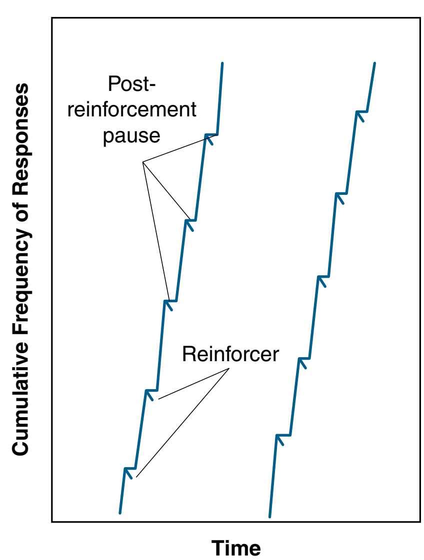


Figure 20.2 Cumulative Graph

Concept

VARIABLE-RATIO SCHEDULES OF REINFORCEMENT

Now let's look at another ratio schedule—a **variable-ratio (VR) schedule of reinforcement**. We call the pattern of behavior it generates a **variable-ratio pattern of responding**.

Definition: PROCEDURE

Variable-ratio (VR) schedule of reinforcement

- A reinforcer is contingent on
- the last of a variable number of responses.

Definition: PRINCIPLE

Variable-ratio pattern of responding

- Variable-ratio schedules produce
- a high rate of responding,
- with almost no post-reinforcement pausing.

Just as CRF and FR are abbreviations for their respective schedules of reinforcement, VR stands for a variable-ratio schedule of reinforcement. We designate a specific VR schedule by numerals following the notation. Let us discuss such a specific schedule, a VR 50. If you have suspected that 50 stands for number of responses, you are correct. But rather than standing for a set or fixed number of responses, as in an FR 50, 50 in a variable ratio designates the *average* number of responses required for the reinforcer.

I've had trouble coming up with clean everyday examples of variable-ratio schedules. But some other behavior analysts answered my Internet plea for suggestions (they should not be held responsible for the literary license I took with their examples).

- Steve Stud hits on the beautiful babes during happy hour at Planet Follywood. His cool line is "Hey, babe, what's your sign?" Believe it or not, that sometimes gets reinforced. Probably a very large variable-ratio schedule of reinforcement. Right? Unfortunately for Steve, it's also punished on a very small variable-ratio schedule.*

* A tip of the hat to Lester Wright, WMU behavior therapist, for this clearly fictional example.

- Under the guise of a budding interest in cultural anthropology, Pubescent Paul skims through his parents' back issues of *National Geographic* magazine in quest for the occasional bare-breasted maiden in her native habitat. Turning pages is reinforced on maybe a VR 350.*
- I can tell my poorly trained dog to sit, and sometimes it takes my saying the "sit" command several times before I get the reinforcing sight of the "dog sitting." And sometimes he will sit on my first command. Putting aside the obvious lack of effective performance-management contingencies for the dog, I believe a variable-ratio schedule controls my behavior of saying "sit."**
- Every now and then the teacher notices that Brutal Bob is picking on the other kids, but many times, Bob sneaks in a pinch or a hit without the teacher's catching him. When Bob is caught, he gets 5 minutes of time-out. Presumably this would be VR punishment. We suspect there may be more cases of VR punishment than VR reinforcement in the everyday world.
- Paul Potato's old TV wasn't working correctly. Every now and then the picture would start rolling, to Paul's irritation. However, if he hit the set, it would stop rolling and the picture would be less irritating (unless Barney was on). Sometimes the rolling would stop after one or two hits, but sometimes Paul would have to hit it several times. (This is really an example of VR negative reinforcement.)
- And then there's the classic sick social cycle where the parents occasionally escape the child's whining and pestering by reinforcing meeting the child's request or by providing some sort of distracting reinforcer. This is a variable-ratio schedule of reinforcement for whining and pestering. As we will see in Chapter 21, such intermittent reinforcement makes the behavior more resistant to extinction—harder to get rid of.

What about the young Bahamian coin diver? Most likely, what was his schedule of reinforcement?

a. continuous
b. fixed ratio
c. variable ratio

The way the world pays off for one attempt and fails to pay off for another has produced the old saying "If at first you don't succeed, try and try again." On the variable-ratio schedule of reinforcement, we can only assume that the more often we attempt, the more often the response will produce a reinforcer.

By the way, *intermittent reinforcement* is a generic term that includes not only fixed- and variable-ratio schedules but also, as we will soon see, other schedules such as fixed- and variable-interval schedules. So do not make the mistake of thinking that intermittent means only one type of schedule, such as variable ratio, for example.

QUESTIONS

1. Define the following concepts:
   a. *variable-ratio schedule of reinforcement*
   b. *variable-ratio pattern of responding*
2. Recall the divers of Nassau. What was their reinforcement schedule?
   a. continuous reinforcement
   b. fixed ratio
   c. variable ratio

Clarification

THE INDEPENDENT VS. DEPENDENT VARIABLES IN SCHEDULES OF REINFORCEMENT

Review: CONCEPTS

Independent variable

- The variable the experimenter systematically manipulates
- to influence the dependent variable.

Dependent variable

- A measure of the subject's behavior.

The independent variable is the ***cause*** and the dependent variable is the ***effect***, the ***results***. So what are the schedules of reinforcement and what are the patterns of responding? The schedules cause the patterns. The schedules are the independent variables and the patterns are the effects, the results.

* A hat tip to Sayaka Endo, Ohio State University, special ed grad student, who will blush to see what I've done with her innocent example.

** Hat tip to Dan Sikora, WMU OBM alumnus, who not only demonstrates a nice VR example but also shows that these examples don't have to involve sex to be interesting.

Example

RATIO SCHEDULES OF NEGATIVE REINFORCEMENT AND NEGATIVE PUNISHMENT

Yasako is a pharmacy student at the University of Victoria. Every Saturday afternoon she meets with her chemistry study group in her apartment on the fourth floor of Coral Reef Apartments. Irritable Mr. Bill lives on the third floor, right below Yasako.

Yasako vacuums her apartment on Saturday mornings, before meeting with her group. Soon after she turns on her vacuum cleaner, Mr. Bill starts hitting his ceiling with a broomstick. At the same time, he starts the most vile swearing and shouts threats that he's going to kill her.

After 12 hits, Mr. Bill's violence has frightened Yasako so much that she turns off the vacuum cleaner, and shortly after that, Mr. Bill quiets down. But after a few minutes, Yasako again begins worrying that her apartment will be dirty when her friends arrive, so she turns on her vacuum cleaner and starts cleaning again. But soon Mr. Bill is at it again, too. She and Mr. Bill alternate back and forth like that, his pounding a few times, followed by her turning off the noisy vacuum cleaner, followed by her turning it back on a few minutes later, around and around until she gets her apartment clean.

But it's Mr. Bill's behavior we're interested in this time. What's reinforcing his pounding on the ceiling? Yasako's turning off the noisy vacuum cleaner. What kind of reinforcement is this? Reinforcement by the removal of an aversive condition (negative reinforcement). Now suppose he pounded 12 times before Yasako turned off the vacuum cleaner the first time. Then 10 times, then 14, then 6, 16, and finally 14 again. What kind of schedule is this? A variable-ratio schedule of negative reinforcement. The average number of Mr. Bill's responses was 12, so we have a VR 12.

Now let's look at another case. Nasty Ned often disrupts his third-grade class with bullying. Teacher Tom notices this only about once out of every three times, on average. And when he does notice, he puts Ned in time-out for 5 minutes. What sort of contingency do we have here? "For whom?" you ask. Good question. In social settings, it's important to stay straight on whose behavior we're analyzing. Ned's behavior. Then assuming time-out is less reinforcing than being in the classroom, we've got a negative punishment contingency. And what kind of a schedule? A variable-ratio negative punishment schedule with a mean of three (VR 3).

QUESTIONS

1. *Variable-ratio schedule of negative reinforcement*—give an example.
2. *Variable-ratio schedule of negative punishment*—give an example.

A Review

COMPARE AND CONTRAST REINFORCER VS. REINFORCEMENT

Remember the definition of **positive reinforc*er***—any stimulus whose *presentation* follows a response and *increases* the future frequency of that response. And contrast that definition with the definition of **positive reinforce*ment***—response-contingent *presentation* of a reinforcer resulting in an *increased* frequency of that response.

So what are the following?

1. A specific pellet of food for a deprived rat?
   a. reinforcer
   b. reinforcement
2. The immediate delivery of a pellet contingent on a deprived rat's lever press with a resulting increased rate of pressing?
   a. reinforcer
   b. reinforcement
3. A quarter for a deprived professor?
   a. reinforcer
   b. reinforcement
4. The immediate delivery of a quarter, contingent on a deprived prof's pleading for a raise, with a resulting increased rate of pleading?
   a. reinforcer
   b. reinforcement

QUESTION

1. Important quiz hint: Know the difference between reinforcer and reinforcement so well that you don't mess it up, even in the heat of a quiz, now or ever.

Example

RATIO SCHEDULES OF REINFORCEMENT AND PUNISHMENT IN EVERYDAY LIFE

Sid's Seminar

Joe: I'm concerned; I spent 2 hours trying to come up with everyday examples, and I couldn't. I don't think there are many.

Max: Well, the behavior analyst in a lab can program fixed-ratio schedules with no trouble.

Joe: Yes, but nature doesn't often program this type of schedule of reinforcement or punishment.

Eve: Also, we don't often see fixed-ratio scheduling of the reinforcers we get from our society, from other people. For instance, professors don't give us grades on a fixed-ratio schedule.

Sid: You're making good points. I also think fixed-ratio schedules of reinforcement and punishment don't have much direct relevance to the reinforcement schedules in our normal world. But the study of fixed-ratio behavior may give us insight into the effects of similar schedules.

Joe: I couldn't find a single example.

Sid: Well, what about variable-ratio schedules? They seem to occur more often in everyday life, like the case of the door-to-door salesperson.

Max: Yes, and the slot machines in Las Vegas: the response is putting money in the slot machine and pulling the handle (or pushing a button). And that gets reinforced after a variable number of responses.

Joe: I think this ratio schedules stuff is all lab hype that has little to do with anyone's everyday life.

Max: That's pretty strong, Joe.

Joe: I'll make a prediction. I predict that almost all the original everyday examples of ratio schedules you guys came up with aren't. I'll bet they involve stimulus control, like watches and calendars. And I'll bet they also include conditioned reinforcers that you're not taking into account, and maybe also aversive control you're not accounting for.

Max: What about the slot-machine example? Isn't that pure variable ratio?

Joe: No way!
First, it's loaded with conditioned reinforcers, in addition to the money.

Max: Like what?

Joe: Like those fruits that appear in the window, one after another—a cherry, another cherry, and then, darn, a lemon. "Well, I almost won." Those two cherries in a row were a big conditioned reinforcer.

*Second is the variable amount of the reinforcer you get at the end of the so-called **variable ratio***. In other words, sometimes you get only one dollar, sometimes it's 10, sometimes it's 18, and so on. None of that's like the ratios behavior analysts study in the Skinner box.

*Third is that **the size of the ratio** is much smaller than is typical in the Skinner box of the professional research lab*—like a variable ratio with a mean of 100 responses, a VR 100? You'd never see that in a casino. The customers would revolt if a machine sometimes went 100 or more times without paying off anything.

Sid: You've got some interesting points there, Joe. In fact, slot machines do pay back about 95 dollars out of every 100 the customers put in them.

Tom: It's too bad the behavior analysts, with all their schedules of reinforcement, aren't in charge of gambling. All the casinos would go broke, and we wouldn't have to worry about legalized gambling.

Eve: You know, the behavior analysts may be missing something else when they compare gambling to their typical variable-ratio schedules. They may be missing the excitement. I've been to Reno, and it really is exciting. I think part of it is the near misses. Like maybe the two cherries Joe mentioned are more than just conditioned reinforcers. It's like almost winning somehow gets you especially excited. So I'd like to add a *fourth factor: The emotional reaction is itself reinforcing*.

Sid: A nice analysis, Eve. Let me summarize the ways typical gambling differs from typical research schedules of variable-ratio reinforcement:

- There are many other conditioned reinforcers interspersed throughout the variable ratio of gambling.
- The amount of the financial reinforcer often varies from ratio to ratio in gambling.
- The size of the gambling ratio is usually much smaller than that in the professional Skinner box.

These factors combine to produce emotional reinforcers in the gambling ratios that may be absent from the variable-ratio schedule of the Skinner box.

So you can see that the typical casino has added many reinforcers to an easy task. This makes life in the casino much more reinforcing than life in the Skinner box. Could that be why more people spend more of their lives in Las Vegas than in Skinner boxes? If experimental behavior analysts ran Las Vegas, it would close down in 6 months out of boredom.

Compare and Contrast the Skinner Box and Gambling

	Typical Skinner box variable ratio	Typical gambling schedule
Many interspersed conditioned reinforcers	No	Yes
Amount of reinforcer varies from ratio to ratio	No	Yes
Small ratio	No	Yes
Emotional reinforcers	No	Yes

Our observation is that most of our contingencies of everyday life involve more or less continuous reinforcement and continuous punishment, with maybe an occasional reinforcer or aversive condition missed. They don't seem to be as intermittent as we might at first think. For example, if you bite into a red apple, it will almost always taste good. If you touch a hot stove, it will almost always feel bad. If you sit down in a chair, it will almost always be there to hold you. Once in a while, our world gets screwy and someone pulls the chair out from under us, but not too often.

QUESTION

1. Give four differences between typical gambling contingencies and the usual variable-ratio schedules of the Skinner box in the professional research laboratory, not necessarily an introductory student lab. Warning: This one may be crucial for getting your *A* today.

DISCRETE-TRIAL PROCEDURES VS. FREE-OPERANT PROCEDURES (G-9)

Most Skinner box research involves ***free-operant*** responding, where the animal is "free" to respond at various frequencies (e.g., 1 lever press per minute to 100 lever presses per minute). In fact, if the animal can make more than one correct response before the reinforcer, it is probably a free-operant procedure. There may not be an S^D, but even if there is, the animal can usually make many responses during each time the S^D is present. And the responses can be reinforced either continuously or intermittently. In other words, in a free-operant procedure, there is no S^Δ immediately after each response, so there is no intertrial interval between each response and the next S^D.

Discrete-Trial Procedure

The light is on in the Skinner box; Rudolph presses the lever. Click. Rudolph has a drop of water and the light goes off. Rudolph presses the lever again. Nothing. Then, after a few seconds, the light comes on again, and Rudolph's pressing is once again reinforced with water.* This is an example of a ***discrete-trial procedure****—there is an S^D, a single response, and an outcome, followed by an S^Δ (intertrial interval); then the next trial starts*. When that single response occurs, the S^D ends and the subject immediately receives a reinforcer or goes into S^Δ. We can't measure Rudolph's rate of pressing, but we can measure the latency of Rudolph's presses.

In the Classroom

Now let's look at discrete-trial and free-operant procedures in the classroom. Here, Mae and crew are using both in their work with Jimmy, the little boy with the big label, autism.

Discrete-Trial Procedure

Sue sits at a small table facing Jimmy. She puts several objects on the table.

First trial

S^D:** Sue says, "Horse."

* This example of a discrete-trial procedure is fairly contrived—it would rarely, if ever, actually be done in a Skinner box.

** Remember, S^D—a stimulus in the presence of which a response will be reinforced or punished. It may help to review the concept of a discriminative stimulus in Chapter 14.

Response: Jimmy points to the horse.
Outcome: Sue says, "Good" (a conditioned reinforcer for Jimmy).
S^{Δ} **(intertrial interval):** Sue says nothing.

Second Trial

S^D**:** Sue says, "Cup."
Response: Jimmy points to the cup.
Outcome: Sue says, "Good."
S^{Δ} **(intertrial interval):** The basic features of this discrete-trial procedure in the classroom are the same as those in the Skinner box. *There is an S^D, a single response, and an outcome, followed by an S^{Δ} (intertrial interval); then the next trial starts*. Again, there is an S^D (maybe the same one as before, maybe a new one), a single response, and an outcome, followed by an intertrial interval. Then Sue starts the next discrete trial:

Third Trial

S^D**:** Sue says, "Shoe."
Response: But this time, he points to the car.
Outcome: So Sue goes into what's called a *correction procedure*; she says, "Shoe," as she points to the shoe. Then she says, "Shoe." This time Jimmy points to the shoe. "Good." And the correction procedure ends. (We can think of that entire correction procedure as the outcome for the third discrete trial.)
S^{Δ} **(intertrial interval):** Behavioral approaches to working with children with autism make much use of discrete-trial procedures. This training has proven so effective that parents of such children often ask their school districts to provide discrete-trial training for their children. As a result, the demand for trained behavior analysts has greatly increased.

Free-Operant Procedure

Now let's look at a different type of training procedure . . .

S^D**:** Sue and Jimmy at the snack table.
Response 1: Jimmy says, "Juice, please."
Outcome: Sue gives him a sip of juice.
Response 2: Jimmy says, "Juice, please."
Outcome: Again, Sue gives him a sip of juice.
S^{Δ}**:** Sue and Jimmy not at the snack table.

Notice that basic features of this free-operant procedure in the classroom are the same as those in the Skinner box. *There may or may not be an S^D; then there can be several responses, with the responses being reinforced either continuously or intermittently*. In a free-operant procedure in the classroom, there is no S^{Δ} after each outcome, and there is no intertrial interval between each outcome and the next S^D.

In the juice example, Jimmy's responses were reinforced continuously. In the next example, his responses are reinforced intermittently. Notice that there is still no S^{Δ} or intertrial interval in the procedure:

Jimmy and Sue are sitting on the floor in the structured-play area.

Response 1: Jimmy picks up one toy and puts it back in the storage box.
Response 2: Then another.
Response 3: And another, etc.
Outcome: Once all the toys are in the box, Sue says, "Good Jimmy; now what do you want to play with?"

In this case, I don't think there's an S^D, at least not for each individual response; our operandum test suggests that each toy is an operandum (like Rudolph's lever), rather than an S^D.

In the classroom, just as in the Skinner box, trials that are separated by intertrial intervals distinguish discrete-trial procedures from free-operant procedures.

Now, suppose you're doing a discrimination experiment with Rudolph: When the light above the response lever is on, lever pressing is reinforced on a variable-ratio schedule. On average, Rudolph's lever presses will be reinforced every 20 times, as long as the light, the S^D, is on. But when the light is off, the S^{Δ}, it is extinction city. You alternate between S^D and S^{Δ} every 2 minutes—light on for two and off for two. And you record Rudolph's rate of lever pressing in the S^D and S^{Δ} to see if he's responding at a higher rate in the S^D than in the S^{Δ}, to see if the light is exerting stimulus control over his lever pressing. So, are you using a discrete-trial or a free-operant procedure?

Use the compare-and-contrast table to figure this out. Is there an S^D and S^{Δ}? Yes, but that's not definitive, because sometimes there's an S^D and S^{Δ} in free-operant procedures.

Compare and Contrast

DISCRETE TRIAL VS. FREE OPERANT PROCEDURES

	Discrete Trial	Free Operant
Is there an S^D and an S^Δ?	Yes	Sometimes
Is there an inter-trial interval?	Yes	Usually not
The measure is	Latency or Accuracy	Rate

Is there an intertrial interval? No. Starting to look like a free-operant procedure, but . . .

What's the measure? Rate. And that nails it. So just because you have an S^D and S^Δ doesn't mean you've got a discrete-trial procedure.

QUESTION

1. What's an example of

   a. a free-operant procedure in the Skinner box?
   b. a discrete-trial procedure in the Skinner box?
   c. a discrete-trial procedure in the classroom?
   d. a free-operant procedure in the classroom?
   e. a free-operant procedure using discriminative stimuli?

Note

1 Based on Findley, J. (1971). Personal communication.

CHAPTER 21

Time-Based Schedules

Behavior Analyst Certification Board 5th Edition Task List Items		
B-5.	Define and provide examples of schedules of reinforcement.	Throughout
C-10.	Graph data to communicate relevant quantitative relations (e.g., equal-interval graphs, bar graphs, cumulative records).	Pages 372–373, 382–383, 385

Concept

EXPERIMENTAL ANALYSIS OF BEHAVIOR

Fixed-Interval Schedules of Reinforcement (C-10)

Now we'll consider interval schedules: ***time-dependent, time-based schedules of reinforcement***. In most of these schedules, the opportunity for reinforcement occurs for the first response after a period of time has elapsed.

First, we'll look at the **fixed-interval (FI) schedule of reinforcement**: In this schedule, reinforcement becomes available after a fixed interval of time since the last opportunity for reinforcement. But the delivery of the reinforcer is contingent on the response. For example, with an FI 2' schedule, reinforcement becomes available after 2 minutes have passed since the last opportunity for reinforcement. On such a schedule, the first response occurring after the interval has timed out produces reinforcement.

Ferster and Skinner[1] studied fixed-interval schedules of reinforcement with pigeons in the Skinner box. Figure 21.1 is what a cumulative response record would look like for a pecking response of a pigeon reinforced with grain on a fixed-interval schedule. Just after reinforcement, a long period of time goes by without the bird making any response whatsoever. After some time, it makes a few responses. Then the pigeon responds more rapidly as time goes by until, at the end of the interval, it responds at an extremely high rate. This particular pattern of responding is typical of a fixed-interval schedule of reinforcement. **Fixed-interval scallop** is the name of the shape this record takes.

Definition: CONCEPT

Fixed-interval (FI) schedule of reinforcement

- A reinforcer is contingent on
- the first response
- after a fixed interval of time
- since the last opportunity for reinforcement.

Definition: PRINCIPLE

Fixed-interval scallop (fixed-interval pattern of responding)

- A fixed-interval schedule often produces a scallop—
- a gradual increase in the rate of responding,
- with responding occurring at a high rate
- just before reinforcement is available.
- No responding occurs for some time after reinforcement.

By *scallop*, we don't mean something you eat at Red Lobster. We mean a *curve*, as in the wavy patterns on an ornamental border. A series of fixed-interval scallops looks something like that ornamental border. A circle is drawn around one of the fixed-interval scallops and then expanded to give you a closer

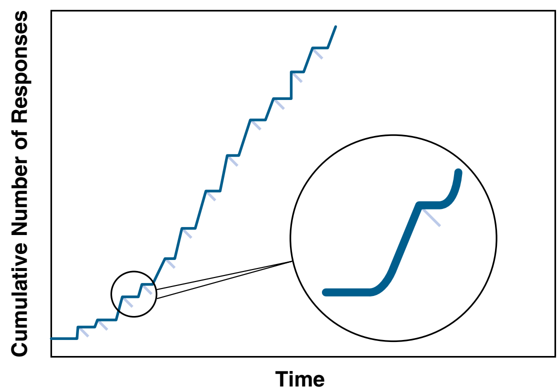


Figure 21.1 Fixed-Interval 2-Minute Schedule

look at the scalloped pattern, the pattern that's typical during the first weeks of an animal's fixed-interval training.* (After considerable training, the cumulative record on a fixed-interval schedule comes to look more like that associated with a fixed-ratio schedule—a pause after reinforcement followed by a rapid acceleration of responding to a high, steady rate.)

QUESTIONS

1. Define and give a Skinner box example of a *fixed-interval schedule of reinforcement*.
2. Explain the difference between the concept of fixed-interval *schedule* and the principle of fixed-interval *behavior* (i.e., *scallop*). (At quiz time, people get confused with this one.)

ARE THERE ANY EVERYDAY EXAMPLES OF FIXED-INTERVAL SCHEDULES?

Now we're going to look at several sets of behavioral contingencies that are often offered as examples of fixed-interval reinforcement but that really aren't. And you'll soon get the message that most of life is much more complex than the simple arrangements normally studied in the Skinner box. But also, I hope that in looking at these everyday examples, you'll become more skilled at using the basic principles and concepts from the Skinner box in analyzing the subtle behavioral contingencies of the real world with all its complexities.

Joe's Term Paper

Students of behavior analysis often give what, at first glance, seem to be everyday examples of fixed-interval schedules of reinforcement. But a closer analysis of the contingencies reveals that they are not. Let's examine one of those deceptive examples.

Sid has assigned a term paper for his seminar. Let's look at Joe's behavior of working on that term paper. Sid assigned the paper the first day of class, so Joe has 15 weeks to complete the project—to meet the deadline. Figure 21.2 is a cumulative record of Joe's work under this schedule. We plotted weeks on the *x*-axis and the cumulative number of hours he worked on the *y*-axis.

The first week after Sid announced the assignment, Joe spent no time preparing the paper. We placed a zero at the comparable point on the graph. The same is true of the second, third, fourth, fifth, sixth, and seventh weeks—Joe spent no time on the paper. Finally, in the eighth week, he spent 5 hours trying to select an appropriate topic. In that week, Joe searched for a topic, talked to several people, even to an instructor, and did some reading. In the next week, his efforts increased only slightly, and slightly more in the

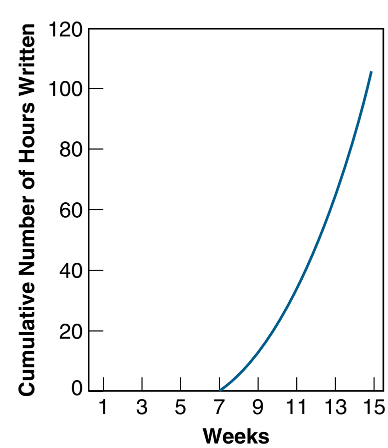


Figure 21.2 A False Fixed-Interval Scallop of Joe's Paper Writing

* In every class, at least one student always asks how you time the interval. There are two ways you can do it, and both produce the same results. Suppose you're doing a 10-minute fixed-interval schedule. Ten minutes have elapsed, and now you're waiting for Rudolph to respond so you can give him his reinforcer. Suppose he waits 2 more minutes before he responds and gets his reinforcer. Do you start timing the next 10-minute interval from the delivery of that reinforcer? Or do you start timing it from the moment when the reinforcer was available and would have been delivered if Rudolph had responded on time? It doesn't matter, because Rudolph will usually respond on time; he'll be responding at such a high rate by the time the reinforcer becomes available that he'll get it within a second or two after the 10-minute interval anyway. So either way of scheduling the next fixed interval will work just fine.

following week. Then still more, and more again the following week, and once more on the week after that. He spent the final week in a frenzy of long hours in the library and worrying about the paper.

You can see that the cumulative record of the hourly work seems to take the form of the fixed-interval scallop we discussed earlier. In the beginning, Joe didn't work at all. Then small but increasing amounts of work followed in the next weeks until the end of the interval, when, with the deadline approaching, Joe pulled all-nighters, trying to meet the requirement.*

An Analysis of the Term-Paper Schedule

Do you think Joe was working under a fixed-interval schedule of reinforcement? Think it through and try to answer this question before you read the next paragraph.

We think not. The requirements of the true fixed-interval schedule and the schedule of term-paper deadlines differ greatly.

1. **Does early responding affect anything?** On a fixed-interval schedule, what effect does responding before reinforcement have? In other words, what's the effect of the bird's pecking the key before the fixed interval has elapsed? None. In the Skinner box, the pigeon can sit on its duff until the interval has elapsed and then make a single key peck. That's all it takes to produce the bird feed. But on a term-paper schedule, what effect does responding have when responding occurs prior to the availability of reinforcement? In other words, what's the effect of working on the paper before the paper's due date has arrived? Enormous. In the university, you can't normally sit on your duff until the due date and then make a single response. Instead, you have to start to work well in advance of the due date. In fact, this feature of the term-paper schedule is more like a ratio schedule than an interval schedule. Joe has to make at least some minimum number of paper-writing responses to get a passing grade, let alone the *A* he's shooting for.

* We don't really have good data on students' patterns of procrastinating in writing large papers. Most behavior analysts assume that the procrastination would resemble a fixed-interval scallop, but it may be that students tend to procrastinate until panic really sets in and then go full-tilt boogie, full speed ahead, all out, day after day or week after week until the paper's done; in that case, there would be no scallop, just a flat line of no responding and then a straight diagonal line of maximal responding.

2. **In everyday life, you often get more if you work harder.** On a fixed-interval schedule, what effect does increasing the number of key pecks have on the amount of the reinforcer? None. But on a term-paper schedule? Normally, the more you work on the paper, the better your grade—the bigger the reinforcer.
3. **What are the relevant response classes?** Everyday examples often involve more than one response class, and we often get confused about which response class is most like the key peck of the Skinner box. Here a response that usually occurs after the due date is more analogous to the key peck. What? Not writing the paper; that should occur before the deadline. Now think about it. What is it? Handing the paper in to the teacher. That response that occurs closest to the reinforcer—the grade. Handing in the paper is most like the key peck.

So what happens if you turn the paper in before the deadline? The response counts; it will still produce the reinforcer, the grade. Normally you don't have to wait until the deadline to turn in your paper early. Of course, your professor might have a heart attack if you did turn it in ahead of time (but you can't count on that reinforcer).**

And what happens to early key pecks on the interval schedule? As we've said so often, nothing.

4. **Everyday life often involves calendars and clocks.** What response functions most like the key peck? Turning in the paper. So maybe we'd get a fixed-interval scallop if we plotted a cumulative record of Joe's turning in the paper. In other words, would he first try to turn it in early in the interval, and then turn it in with increasing frequency as the due date approached, until he finally turned it in for the last time, just after the due date? Of course not! Not even Joe would do that.

Why not? Why no scallop? Because Joe has a calendar and a clock. He won't turn it in until the interval has elapsed, not until the calendar shows the right date and the clock shows the right hour.

How would you change the interval schedule in the Skinner box to be most like this? Think! You'd give the pigeon Joe's calendar and clock. To make it simple, let's just give the bird a clock—a simple device, just a big second hand that sweeps into the black area when the interval has elapsed. What do we call the stimulus configuration when the hand is in the black?

** Just a cheap joke, based on the mythic student–teacher antagonism. Of course, your professor's heart attack wouldn't be a reinforcer for you, would it?

A discriminative stimulus (S^D). In the presence of that time on the clock, a key peck will produce the grain (and also start the clock running again). What do we call the configuration when the hand is in the white? An S^Δ. Grain isn't available then.

What kind of schedule of reinforcement would we have if we supplemented the fixed-interval schedule with our simple clock and "taught the bird to tell time" (brought the key peck response under the stimulus control of the clock)? We'd have a simple discrimination schedule (sometimes called a *multiple schedule*)—extinction in S^Δ and continuous reinforcement in S^D (except each S^D would end as soon as the bird responded and got its reinforcer).

How do you think the bird would come to respond under this simple discrimination schedule? It would not peck the key until the clock said the interval had elapsed—until it was time to—until the S^D. That's just like Joe; he wouldn't hand in his paper until his calendar and clock said it was time to. The bird then pecks the key and gets the food. Joe then turns in his paper and gets a thank you, if he's lucky.

5. **Everyday life often involves deadlines.** The fixed interval elapses, and the pigeon's reinforcer is now available. The next key peck will produce food. What happens if the pigeon waits a few minutes before pecking? Nothing special; it'll still get the food.

The last day of class arrives, and it's time for Joe to turn in his paper. What happens if he waits a few weeks? He will have lost his chance to have Sid grade his paper. He'll get zero for his efforts. In other words, Sid and the university administration have put a deadline on the term-paper schedule. But the typical fixed-interval schedule doesn't have a deadline.

6. **Everyday life often involves reinforcers that are too delayed to reinforce the causal response.** How soon does the pigeon get its food after it pecks the key? Immediately. How soon does Joe get the grade after he writes and turns in his paper? A few days later, if Sid's on the ball. But that delay's too great to reinforce Joe's writing and turning in his paper. A complex set of contingencies controlled Joe's writing his paper, more complex than the simple reinforcement of his writing by the grade he will ultimately receive. We'll talk more about these complex contingencies in later chapters.
7. **Summary of the term-paper schedules.** Sometimes a table's worth a thousand words. Let's see if this is one of those times.

Contrasting the Fixed-Interval and the Term-Paper Schedules

Feature	Fixed-interval	Term-paper
Does early responding affect anything?	No	Yes
Do you get more* if you work harder?	No	Yes
Is the relevant response class clear?	Yes	No
Are there calendars and clocks?	No	Yes
Is there a deadline?	No	Yes
Is the reinforcer too delayed?	No	Yes

* By *affect anything*, we mean, for example, more food or a better grade. By *work harder*, we mean, for example, peck the key or press the lever more often or spend more hours writing the paper or write a longer paper.

QUESTION

1. Please give a proposed example of a fixed-interval schedule of reinforcement and explain why it ain't.

THE PIGEON VS. THE UNITED STATES CONGRESS

What's the cumulative record of pecking a key by a pigeon on a fixed-interval schedule in a Skinner box? The fixed-interval scallop. The pigeon pauses for a long time following a reinforcer, and then, after her first key peck, her frequency of pecking gradually increases, until right before time for the next reinforcer, she's pecking as fast as her little beak can peck.

And what's the classic cumulative record of passing laws by the United States Congress in Washington, DC? Also a scallop, just like the pigeon's cumulative record. The members of Congress return from their annual recess (a presumed reinforcer). Congress pauses for a few months, and then, after they pass the first law, the frequency of law passing gradually increases until, right before time for next recess, Congress is in a law-passing frenzy.

So here's the question: Is Congress's law passing reinforced on a fixed-interval schedule of reinforcement, just like the pigeon's key pecking? In other words, law passing is a scallop, but is it the result of a fixed-interval schedule of reinforcement? The authors of an excellent, peer-reviewed article in an excellent journal said yes; that was the point of their article.

However, being an iconoclast, my goal for this section is to show that Congress is *not* working on a fixed-interval schedule. In fact, none of the components of Congress's schedule even resemble a fixed-interval schedule. In this analysis, I assume Congress won't get its recess unless it has voted on some minimal number of laws, the laws the Congressional leaders have committed Congress to consider. If they haven't passed (or voted on) enough laws when recess time comes, they won't get recess until they do! In this analysis, we'll ask the same questions we asked of Joe's term-paper schedule.

1. **Does early responding affect anything?** What happens if Congress responds before it can actually get the reinforcer—the recess? Will those early responses influence getting the reinforcer, when the reinforcer finally becomes available? For the pigeon's fixed-interval schedule, early responding has no effect. But remember for Joe's term-paper schedule, early responding had a big effect on getting his paper done on time and getting a good grade. And for Congress's passing laws, does early responding have any effect? Absolutely. Congress is busy doing the groundwork needed for the passage of the laws, before starting to actually pass them. (True, doing the groundwork is not the same response class as passing the laws, but it is effective behavior.)
2. **Does working harder produce more reinforcer?** Or, at least, does working hard keep the reinforcer from being smaller? On the pigeon's fixed-interval schedule, suppose two pigeons are on schedules where the interval between availabilities for reinforcement is 1 minute. The fast pigeon responds from 20 to 40 times in each 1-minute interval, and the slow pigeon responds from 2 to 4 times in each interval (so the slow pigeon will miss essentially no reinforcers). Will the faster pigeon get more food compared to the pigeon that's doing at least a minimal amount of work? No, they'll both get one food reinforcer about every minute on the average. On Joe's term-paper schedule, might Joe get a better grade if he works harder on his paper? Absolutely. And will members of Congress get less recess if they sit on their collective hands until time for recess? Absolutely; note that Congress must come back to work on a pre-arranged day, so, if they get out late, they will have a shorter recess. (By the way, even though passing a law may violate the reinforceable response unit test, that's what we're looking at here.)
3. **The final response (and the relevant response class)?** Is the delivery of the reinforcer at the end of the scallop actually contingent on a member of the class of responses that occurred during the scallop? (In other words, do they need to make one more of those responses, after the "deadline"?) Yes, to get the reinforcer, the pigeon must make a final key peck after the fixed interval has elapsed and the reinforcer is available. And for Joe, the response class during the scallop is writing his paper. But he shouldn't wait until after the deadline to write the last few lines of his paper, in order to have his paper accepted. Joe's professor would be happy to accept his paper even if he'd finished it way before the deadline and then turned it in just before the deadline. And similarly, members of Congress shouldn't wait until after the time for recess has arrived to pass their final law and get that recess. If they pass all the laws before time for recess, then when time for recess arrives, they're free to go to recess without passing any more laws. For Joe, the final response is turning in his paper, but for Congress, there is no final response after the deadline on which the recess is contingent.
4. **Immediate reinforcer?** Does the reinforcer always follow the specific response that produced it within 60 seconds (so it's soon enough to reinforce that response)? Yes, for the pigeon's key peck. But Joe won't get the grade for his paper within 60 seconds after he hands it to his professor, at least not in any university I've ever seen. And similarly, Congress won't actually get its recess within 60 seconds after passing the last law.
5. **The tick-tock criterion?** Does the pigeon have access to a clock or calendar? Of course not. If the pigeon did, she'd wait until the fixed interval had elapsed and then peck the key once—bye-bye fixed-interval scallop. Does Joe have access to a clock or calendar as he works on his paper, or at least when he's supposed to be working on it? Absolutely; otherwise, he'd completely blow the deadline. And Congress? Of course.
6. **A deadline for getting the reinforcer or for getting the full reinforcer?** For the pigeon's fixed-interval schedule, it helps to assume that the pigeon stays in the Skinner box until it gets all 60 of its scheduled reinforcers (a common procedure). So, of course, she has no deadline. For Joe's turning in his paper? Of course he has a deadline; otherwise, he'd procrastinate forever. And for Congress's passing laws? Yes, there's a deadline on getting the maximum amount of recess. So what's really going on with Joe and the members of Congress is that they're busting their butts to avoid losing the opportunity to get the maximum reinforcer, a grade of *A* or a full recess. Whenever there's a deadline, we've always got some sort of avoidance contingency, in this case avoidance of the loss of the opportunity to get a reinforcer or the maximum reinforcer. Congress's law passing is also supported by another avoidance contingency—avoidance of the wrath

of the voters that would occur if Congress doesn't pass a reasonable amount of legislation before the end of the session.

7. **The fixed-interval bottom line.** As with Joe, every way we compare the contingencies, Congress's law-passing behavioral contingencies have nothing to do with a fixed-interval schedule of reinforcement; in fact, it's more like a fixed-ratio schedule than a fixed-interval schedule, but even that's far from an exact fit. We've started a summary of our comparisons, please help us finish:

Issue	Pigeon's true fixed interval	Congress's pseudo fixed interval
Does early responding affect anything?	No	Yes
Do you get more if you work harder?	No	Yes
Is the final response the same as the previous responses?		
Is the reinforcer too delayed?		
Other contingencies?		
Are there calendars and clocks?		
Is there a deadline?		

8. **What would a true fixed-interval schedule of reinforcement for Congress be?** Let's follow the table: Passing laws before time for recess would have no effect. So working harder would have no effect. When it came time for recess, they'd pass one law, and within 60 seconds they'd find themselves out of Washington, DC, and sunbathing at Miami Beach with a rum and Coke in hand. And, oh yes, because there was no clock or calendar, the cumulative record of their law passing would scallop as it does now, though they'd not do any preparation for each bill they thoughtlessly passed. Finally, they'd get the same length of recess whenever they passed that final law, as they'd have no deadline.

OK, if it's so clear to you and me that Congress's law passing isn't reinforced on a fixed-interval schedule, why did the brilliant authors, reviewers, and editors of the outstanding, high-class behavior analysis journal screw it up; why did they think it was? Well, I suspect they were so eager to show the value of behavior analysis and basic experimental research that they made this simplistic extrapolation from the Skinner box, without thinking it through carefully enough, a sin we behavior analysts often commit. And my real goal is not to indulge my own lust for iconoclastic reinforcers. And it's not to discourage you from analyzing everyday events in terms of the principle of behavior derived from basic Skinner box research. Instead, I encourage you to do so, but with greater care than some of our most brilliant behavior analysts have done in the past. Watch out for your intellectual and cultural biases.

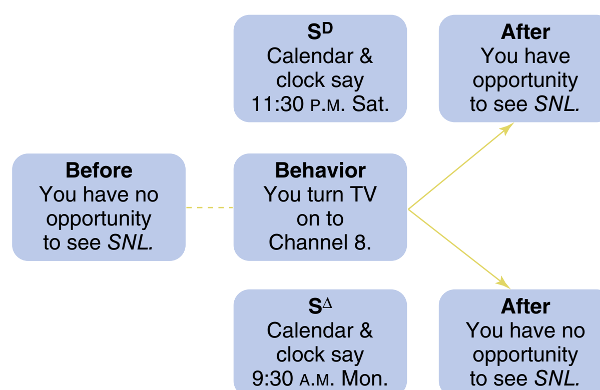
Now let's take a quick look at a couple more everyday examples.

OTHER NON-EXAMPLES OF FIXED INTERVAL SCHEDULES OF REINFORCEMENT

The TV Schedule

OK, maybe the term-paper schedule isn't a good example of a fixed-interval schedule. But what about watching *Saturday Night Live* (*SNL*) every Saturday night at 11:30 P.M.? Isn't that a 7-day fixed-interval schedule?

Let's diagram it.

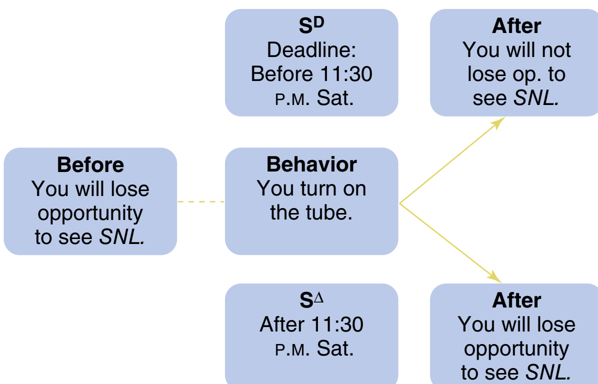


The *SNL* schedule also fails to ring the (cow)bell. There are two problems:

Problem 1. You have a calendar and a clock. But Rudolph has none. If you didn't, you might respond much like Rudolph; starting about Thursday morning you'd be flipping on the TV every few minutes, responding more and more quickly as time passed, until by 11:30 P.M. Saturday night, the remote control would be smokin'. Fortunately for you and your remote control, your flipping on the TV is under good stimulus control. So tuning into your favorite TV show is not an example of a fixed-interval schedule of intermittent reinforcement.

Problem 2. You have a deadline, and Rudolph doesn't, at least not on a simple fixed-interval schedule. If you don't flip on the TV by the deadline of Saturday at 11:30 P.M., you will miss some or all of the reinforcer, *SNL*. Rudolph doesn't have a deadline, once his fixed interval has elapsed, he can take his own sweet time to press the lever, because the reinforcer will still be waiting for him.

Actually, your TV contingency is avoidance of the loss of the opportunity to receive a reinforcer, the complete *SNL*.

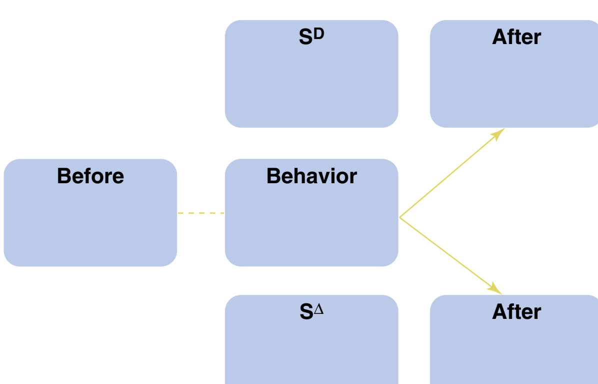


Glancing at your watch is something else; that might be more like Rudolph's fixed-interval schedule, but still not perfect, because what you see when you glance at your watch will sort of act as an S^D or S^Δ for the next glance, and also, you're still working on an avoidance schedule.

The Paycheck Schedule

Ready for another try? What about going to pick up your paycheck at the end of every 2 weeks? Surely that must be a fixed interval of 2 weeks? Diagram time again. But this time, it's your turn.

1. Please diagram the paycheck contingency.



2. This diagram shows that going for the biweekly paycheck is

a. reinforced on a biweekly fixed-interval schedule of reinforcement.
b. under stimulus control and reinforced every time the S^D is present.
c. under stimulus control and reinforced on a biweekly fixed-interval schedule of reinforcement.

3. If going for the paycheck were really reinforced on a fixed-interval schedule, we'd expect to see that behavior

a. spread across 2 weeks on a fixed-interval scallop, which is what happens.
b. spread across 2 weeks on a fixed-interval scallop, which is not what happens.
c. occur just once, when the check is available, which is what happens.
d. occur just once, when the check is available, which is not what happens.

A Correct Example of a Fixed-Interval Schedule of Reinforcement

But all is not lost. Here's an example a student gave: You're watching a rerun of *The Simpsons*. The commercials come on, so you switch to *Law and Order*. But you keep switching back to *The Simpsons* with increasing frequency as the commercial interval wears on. After an agonizing eternity, one of your flips is reinforced by the sight of *The Simpsons*. This is a pretty good example of an interval schedule; if the commercial breaks are the same duration, then we've got a fixed interval. It also has something like what we call a ***limited hold*** on it, in that the longer it takes you to get back to the channel playing *The Simpsons*, the more of the reinforcer you will miss.

Even though this example is pretty good, we maintain that it is extremely difficult to find examples of pure schedules in everyday life. So, in the future when you hear someone talking about a real-life example of a fixed-interval schedule, be critical. Remember those examples are the exception, not the rule.

QUESTIONS

1. Describe the behavioral contingency supporting the writing of a term paper, and contrast it with a fixed-interval schedule of reinforcement.
Warning: To get this one right, you must know and understand the preceding six differences and be able to construct and fill in the preceding table correctly.

2. Describe the behavioral contingency supporting Congress's law passing, and contrast it with a fixed-interval schedule of reinforcement.

3. Diagram the avoidance contingency for turning on the TV to watch a weekly TV show and give the two reasons why it is or isn't a good example of a fixed-interval schedule.
4. Diagram the contingency of going for your biweekly paycheck and explain why it is or isn't a good example of a fixed-interval schedule.

The moral of these everyday-life analyses is that there are few pure examples of traditional schedules of reinforcement outside of the Skinner box.

Example

SUPERSTITION IN THE PIGEON[2]

Dr. Skinner put a pigeon in a Skinner box that was just large enough for the bird to pace a half-dozen steps in any direction. The box contained the usual reinforcer dispenser, a birdseed feeder, but the response key was disconnected. Soon after Skinner put the bird in the box, he started a repeating timer set for a 15-second interval. At the end of each interval, the feeder came up for a few seconds and remained within the bird's reach, allowing it time to eat some grain. Note that the feeder came up at the end of each 15-second interval, regardless of what the bird was doing. In other words, the feeder's raising was independent of the bird's behavior and would have occurred even if the box were empty.

The first time Skinner put the first bird in the box, it immediately began to strut about, first going to this corner and then that, scratching on the floor, and pecking here and there. After 15 seconds, the birdseed feeder came up. Just prior to this, the pigeon had made an abrupt counterclockwise turn. So the presentation of the food just happened to reinforce that counterclockwise turn. After eating the birdseed, the pigeon once again strutted about the box. But soon it made a couple more counterclockwise turns just before the next 15-second interval had passed and the birdseed feeder came up.

From then on, the bird performed a regular, stereotyped pattern of behavior—rapid and persistent counterclockwise turns. It stopped turning only when the birdseed reinforcer was presented; at that time, the bird went immediately for the grain. If visitors had seen the bird during this final stage, they'd have said it was disoriented, silly, or drunk.

The same procedure with another bird accidentally reinforced a head-tossing response much like that of a bull tossing a matador on his horns. After a few sessions of this accidental, coincidental reinforcement, the head tossing occurred at a high frequency whenever Skinner placed the bird in the Skinner box. Other pigeons developed a pendulum motion with their heads, swinging them back and forth, as if keeping time to an unheard melody when they experienced this repeated, accidental reinforcement contingency.

Analysis

EXPERIMENTAL ANALYSIS OF BEHAVIOR

Fixed-Time Schedules and Superstitious Behavior

Skinner used a **fixed-time schedule of reinforcement**. In this schedule, a reinforcer is delivered after the passage of a fixed period of time, regardless of the behavior of the organism. In other words, the reinforcer will be delivered at the end of a specific period of time, whether or not the organism responds. Skinner programmed the delivery of grain every 15 seconds, independent of the pigeon's response.

Definition: CONCEPT

Fixed-time schedule of reinforcer delivery

- A reinforcer is delivered
- after the passage of a fixed period of time,
- independent of the response.

We saw what would happen if we dispensed reinforcement independent of behavior on a fixed-time schedule. This schedule is one way to produce **superstitious behavior**. Because the delivery of reinforcers depended only on the passage of time, pigeons developed whirling, head bobbing, and other weird behavior patterns.

The fixed-time schedule does not require a response for the reinforcer to occur, but the fixed-interval schedule does. On the fixed-interval schedule, a response must occur after the interval elapses, before the reinforcer is delivered.

Definition: CONCEPT

Superstitious behavior

- Behaving as if the response causes
- some specific outcome,
- when it really does not.

The pigeon behaved (whirled and bobbed) as if that response sequence caused some specific following event (the delivery of the food reinforcer), when it really didn't.

Like the pigeon's superstitious behavior, coincidental or accidental reinforcement may account for some superstitious human behavior. For instance, baseball players often develop superstitious behavior. A successful hit accidentally reinforces behaviors that immediately preceded the hit. The result could be that the batter would consistently tap the ground with his bat two times right before the pitcher pitches. But such behavior does *not* produce a successful hit; it's just the result of accidental reinforcement.

Note that this is all quite different from what we think of when we hear the word "superstition." Much typical superstitious behavior, like throwing salt over your shoulder after you spill it or not walking on cracks in the sidewalk, is controlled by verbal behavior. We hear a silly rule as a child, and it ends up controlling some of our behavior quite well for the rest of our life, even though it's utter nonsense.

QUESTIONS

1. *Fixed-time schedule of reinforcer delivery*—define it.
2. Describe Dr. Skinner's experiment demonstrating the effects of a fixed-time schedule of reinforcer delivery. Specify:
   - a response class
   - the schedule of reinforcement
   - the reinforcer
   - the results
   - the name for the general type of behavior this schedule can produce
   - any other interesting features of the intervention
3. *Superstitious behavior*—define it.
4. Give and analyze a human example that illustrates the role of accidental reinforcement.

Compare and Contrast

INTERVAL SCHEDULES VS. TIME SCHEDULES OF REINFORCEMENT (B-5)

One of the main reasons for presenting the fixed-time schedule is so we can contrast it with the fixed-interval schedule. Why would we go to all the trouble to do that? Because students often make the mistake of talking about a fixed-interval schedule as if it were a fixed-time schedule, as if the reinforcer would be delivered regardless of whether the organism responds.

Students often say something like this: "On a fixed-interval schedule of reinforcement, the pigeon pecks the key at an increasing rate. And then after the fixed interval has elapsed, the bird receives the reinforcer." No. After the fixed interval has elapsed, *the next response* produces the reinforcer. (Of course, the responses prior to the end of the interval have no effect.)

Don't make that mistake. Instead, always remember, with the interval schedules, the passage of time brings about the *opportunity* for reinforcement, but time alone is not enough for the actual delivery of the reinforcer. The organism has to make a response for reinforcement to occur. This second requirement ensures that the delivery of reinforcement is contingent on a specific behavior.

So fixed-time schedules of reinforcer delivery and fixed-interval schedules of reinforcement are comparable in this way: They both involve the passing of a fixed period of time before the reinforcer is delivered. They contrast in this way: The interval schedule requires a response after the time period has passed; the time schedule does not.

Interval vs. Time Schedules

	Interval	Time
Involves time	Yes	Yes
Requires a response	Yes	No

QUESTION

1. Compare and contrast a fixed-time schedule of reinforcer delivery and a fixed-interval schedule of reinforcement. (Students have blown this one in the past.)

Concept

VARIABLE-INTERVAL SCHEDULES OF REINFORCEMENT

Behavior analysts have studied the effects of many time-dependent schedules of reinforcement. The **variable-interval (VI) schedule of reinforcement** is another such schedule. In this schedule, reinforcement becomes available after a variable interval of time since the last opportunity for reinforcement.

The delivery of the reinforcer is contingent on the response. Reinforcement becomes available after the passage of variable intervals of time. The specific values of the schedule come after the VI abbreviation. For instance, a VI 2′ schedule is one in which reinforcement becomes available after an average of 2 minutes.

Definition: CONCEPT

Variable-interval (VI) schedule of reinforcement

- A reinforcer is contingent on
- the first response
- **after** a variable interval of time
- since the last opportunity for reinforcement.

Note that reinforcement becomes available after the passage of an average interval of time. On a VI schedule, reinforcement may become available, say, after 5 minutes, but the subject does not actually get the reinforcer until making the proper response. Although time alone will bring about the opportunity for reinforcement, the subject must respond thereafter. But making the appropriate response before the end of the interval will not yield reinforcement. It takes both a time interval and the appropriate response after the passage of that time interval. Only under these two conditions will reinforcement follow.

Let's sum up the features of a VI schedule like this:

- The opportunity for reinforcement comes as a direct function of the passage of time. Thus, we can call the VI schedule a time-dependent schedule.
- The lengths of the intervals between opportunities are varied, hence the term *variable interval*.
- Although the opportunity for reinforcement occurs as a function of time alone, the subject must make the response after the interval is over for reinforcement to occur. Time alone will never bring about the reinforcer.

What kind of behavior do variable-interval schedules generate? Figure 21.3 is what a cumulative response record would look like for a pecking response of a pigeon reinforced with grain.

The bird was working on a variable-interval 2-minute (VI 2′) schedule. (The VI 2′ schedule means that the opportunity for reinforcement came about on an average of every 2 minutes.) Once the opportunity became available, the pigeon had to peck the key to get the reinforcer. You can see in the slope of the cumulative record that the pigeon was pecking regularly but not with a speed that you might expect from the ratio schedules you studied earlier. Generally, the smaller the average interval between opportunities for reinforcement, the higher the rate will be. Thus, if there were a 2- or 3-hour wait between opportunities, we would expect a low rate of responding, perhaps as low as one peck every 10 or 15 minutes. If, on the other hand, the opportunity for reinforcement occurs often, the rate of response will be higher.

Also, you can see in the cumulative record that reinforcement doesn't occur regularly. Sometimes only a few seconds passed between the times the reinforcer become available, and sometimes several minutes passed. And sometimes the bird made many responses from one reinforcement to the next, and other times it made only a small number of responses. The number of responses is a function of the variable interval between reinforcements. But the most important aspect of the variable-interval schedule is that it generates consistent response rates. Notice there are only a few points in the cumulative record where the pigeon failed to respond. There are virtually no flat areas. The slope of the record tends to be even and uniform throughout. The variable-interval schedule produces a steady though not especially fast worker. There are no real post-reinforcement pauses; other than the time the bird takes to consume the grain, the pigeon doesn't stop; instead, it eats and gets back to its rather leisurely working pace.

And remember, the schedule of reinforcement is the independent variable, and the pattern of responding is the effect. In other words, whether the schedule is ratio or interval and fixed or variable determines (causes) the particular pattern of responding.

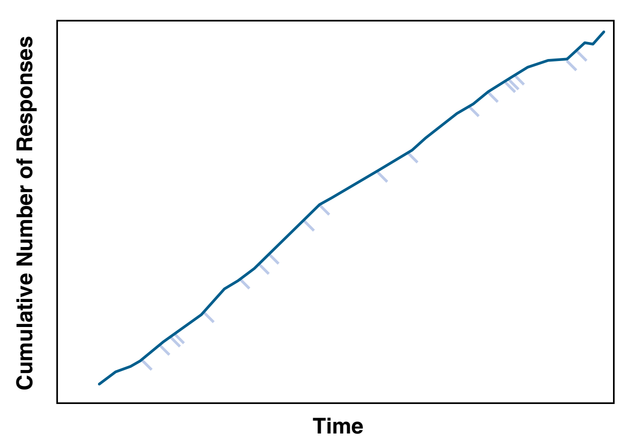


Figure 21.3 Variable-Interval 2-Minute Schedule

Definition: PRINCIPLE

Variable-interval pattern of responding

- Variable-interval schedules produce
- a moderate rate of responding,
- with almost no post-reinforcement pausing.

QUESTIONS

1. *Variable-interval schedule of reinforcement*—define it and give an example.
2. Explain the difference between the concept of variable-interval *schedule* and the principle of variable-interval pattern of *responding*. (At quiz time, people get confused with this one.)
3. Describe the procedure and behavioral results of a variable-interval 2-minute schedule of reinforcement (VI 2′).
4. List three characteristics of variable-interval schedules.
5. *Students often blow this one*: On a variable-interval schedule of reinforcement, must a response occur before the reinforcer is delivered?
6. Relatively speaking, describe the response rate with a variable-interval schedule if the time intervals between reinforcements are small or the time intervals are big.

Concept

EXTINCTION AND SCHEDULES OF REINFORCEMENT

We've said responses can produce reinforcers in two ways:

- Continuous reinforcement: Every response produces a reinforcer.
- Intermittent reinforcement: Only some responses produce a reinforcer. Furthermore, we've considered four classic intermittent schedules:

Classic Schedules of Intermittent Reinforcement

	Fixed	Variable
Ratio	Fixed-ratio	Variable-ratio
Interval	Fixed-interval	Variable-interval

We can make a general statement about these classic schedules of intermittent reinforcement: *Intermittent reinforcement makes the response more resistant to extinction than does continuous reinforcement*. Remember that the extinction procedure consists of no longer reinforcing a response previously reinforced. So the rate of that response decreases. And if we stop reinforcement long enough, the response will stop.

When we stop reinforcement for responses maintained on a continuous reinforcement schedule, the behavior extinguishes rapidly. When we stop reinforcement for responses maintained on an intermittent schedule of reinforcement, extinction takes longer. The subject continues to respond for a longer period of time, although we have withheld reinforcement completely. Thus, we say intermittent reinforcement produces greater **resistance to extinction**.

Definition: CONCEPT

Resistance to extinction

- The number of responses or
- the amount of time
- before a response extinguishes.

Definition: PRINCIPLE

Resistance to extinction and intermittent reinforcement

- Intermittent reinforcement
- makes the response
- more resistant to extinction
- than does continuous reinforcement.

Some intermittent schedules of reinforcement generate behavior that resists extinction more than others do. The more an intermittent schedule differs from continuous reinforcement, the more the behavior resists extinction. For example, a fixed ratio of 10,000 will cause the response to resist extinction a heck of a lot more than will a fixed ratio of 10. But all intermittent schedules generate behavior that resists extinction more than does the continuous reinforcement schedule. So if we want to prevent the response from collapsing at the first sign of non-reinforcement, we should use intermittent reinforcement.*

And to summarize, the size of the schedule of reinforcement is the independent variable that determines not only the pattern of responding, but also the resistance to extinction, the dependent variable.

QUESTIONS

1. The concept of *resistance to extinction*—define it and give an example.
2. The principle of *resistance to extinction*—define it and give an example.

Compare and Contrast

RATIO AND INTERVAL SCHEDULES OF REINFORCEMENT

When Does the Reinforcer Occur?

Remember, in ratio schedules, the reinforcer follows a specific number of responses. If the schedule is a fixed ratio, the reinforcer follows a fixed number of responses. And, after an initial post-reinforcement pause, responding occurs at a high, steady rate until the next reinforcer is delivered. But if the schedule is a variable ratio, the reinforcer follows a variable number of responses. In the variable-ratio schedule, responding occurs at a high rate with almost no post-reinforcement pause.

In interval schedules, the reinforcer follows the first response at the end of a time interval. If the schedule is a fixed interval, responding does not occur immediately after reinforcement but increases in frequency as the interval advances. By the end of the interval, responding is rapid. We call such a pattern of behavior the fixed-interval scallop. If the schedule is a variable interval, the reinforcer follows the first response after a variable time interval. In variable-interval schedules, responding occurs at a consistent rate with almost no post-reinforcement pause.

What's the Relation Between Rate of Responding and Rate of Reinforcement?

1. With ratio schedules, the faster you respond, the more reinforcers you will get per hour.

   a. true
   b. false

2. With interval schedules, the faster you respond, the more reinforcers you will get per hour.

   a. true
   b. false

In theory, you could earn an unlimited number of reinforcers per hour on a ratio schedule if you could respond fast enough; on an interval schedule, you have to respond faster than the shortest interval, but responding faster doesn't help. For example, on a fixed-interval, 1-minute schedule, you can't earn more than 60 reinforcers per hour, even if you're faster than Superman.

But don't think that Rudolph "knows" he will get more reinforcers per hour if he responds faster on a ratio schedule. In fact, if he's been on a fixed-interval schedule long enough, maybe a couple of months, he'll respond as fast there as he would on a comparable ratio schedule; in other words, he'll respond much faster than he would need to get his maximum number of reinforcers. Don't expect rats to be any more rational than human beings.

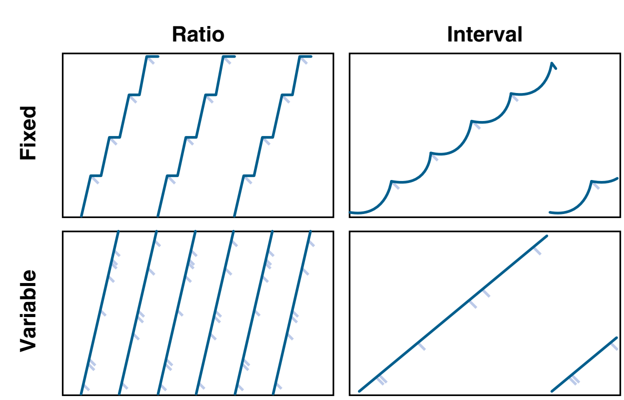


Figure 21.4 Basic Schedules of Reinforcement

* Yes, you can maintain behavior on a ratio as extreme as 10,000 key pecks per reinforcement. When I taught at Denison University, I had Polly Pigeon on a simultaneous discrimination schedule where she worked all day pecking the S^D key. Immediately after Polly had knocked off her 10,000th correct discriminative response, I'd generously give her several minutes' access to grain, rather than the typical 3 seconds' access. Of course, I started out with short ratios and only gradually increased their size, to avoid ratio strain. My students sometimes accuse me of using a similar schedule in my courses. Maybe they're suffering from ratio strain. Maybe I don't increase the assignment sizes slowly enough. Or maybe they aren't satisfied with several minutes' access to pigeon food.

CUMULATIVE RECORDS OF THE FOUR BASIC SCHEDULES OF REINFORCEMENT

Figure 21.4 is a stylized version of the cumulative records of the four basic schedules of reinforcement: fixed ratio, variable ratio, fixed interval, and variable interval. The cumulative number of responses goes up the vertical axis (the *y*-axis, or ordinate). Time goes along the horizontal axis (*x*-axis, or abscissa). The diagonal pips indicate the delivery of reinforcers. The steeper (more vertical) the cumulative records, the higher the response rate. Flat horizontal lines indicate the passage of time with no responding. The ratio schedules show the highest rates of responding, and the fixed schedules show the most pausing after reinforcement.

Comparing and Contrasting Ratio, Interval, and Time Schedules of Reinforcement

Schedule	Reinforcer Follows	Pattern of Behavior
RATIO	A number of responses	
Fixed ratio	A fixed number of responses	After a response is reinforced, no responding occurs for a period of time. Then responding occurs at a high, steady rate until the next reinforcer is delivered.
Variable ratio	A variable number of responses	Responding occurs at a high rate, with almost no post-reinforcement pause.
INTERVAL	The first response after a time interval	
Fixed interval	The first response after a fixed-time interval	No response occurs immediately after reinforcement. Then the rate of responding increases slowly as the interval advances, until the final quarter of the interval where responding occurs at a high rate (fixed-interval scallop).
Variable interval	The first response after a variable-time interval	A consistent and steady rate of responding occurs, with almost no post-reinforcement pause.
TIME	A time period whether or not there is a response	
Fixed time	A fixed-time period whether or not there is a response	Typically, there will be no behavior, unless it is superstitious behavior resulting from the accidental reinforcement of the response of interest.

QUESTIONS

Warning: Please take these questions more seriously than those students in the past who didn't and thereby blew their A.

1. Draw and recognize the cumulative records for each of the four basic schedules of reinforcement.
2. Construct and understand the summary table. In other words, specify the differences between ratio, interval, and time schedules of reinforcement in terms of
   a. availability of reinforcement
   b. resulting behavior
3. Understand the relation between the rate of responding and the rate of reinforcers for ratio and interval schedules.

INTERMITTENT REINFORCEMENT AND RESISTANCE TO EXTINCTION

The ***principle of resistance to extinction*** states that *intermittent reinforcement makes behavior more resistant to extinction than does continuous reinforcement*. That's right, but why? Why do the Skinner box rats appear to work harder rather than less hard when we pay them off for the hard work with less frequent reinforcement? At first glance, that makes no sense.

Do you want the impossibly complex but more accurate answer or the easy answer? The easy one? OK.

It's ***easy*** for the rats to "tell the difference" between ***continuous reinforcement*** and extinction. Why? Because during continuous reinforcement, all the responses produce reinforcers, and during extinction, none of them do. In other words, it's easy for the rats to "tell the difference" between frequent reinforcement and no reinforcement.

But, it's ***hard*** for the rats to "tell the difference" between ***intermittent reinforcement*** and extinction. Why? Because during intermittent reinforcement, only an occasional response produces a reinforcer, and during extinction, none of them do. In other words, it's hard for the rats to "tell the difference" between only an occasional reinforcement and no reinforcement.

So, because the extinction is much like intermittent reinforcement for the rats, the ones that had intermittent reinforcement keep on responding much as they had during intermittent reinforcement. And because extinction is so different from continuous reinforcement, the rats that had had continuous reinforcement quickly stop responding.

In other words, the rats quickly discriminate between continuous reinforcement and extinction, but they greatly generalize between intermittent reinforcement and extinction. In still other words, stimulus generalization explains why intermittent reinforcement makes behavior more resistant to extinction than does continuous reinforcement.

QUESTION

1. Why does intermittent reinforcement make behavior more resistant to extinction than does continuous reinforcement?

Compare and Contrast

RESISTANCE TO EXTINCTION VS. RESPONSE STRENGTH

Early in his career, Skinner introduced the concept of *response strength*—how strong a response is. There are several ways you might measure response strength; for example, response frequency (like frequency of key pecking on a VI schedule) and resistance to extinction (like frequency of key pecking once you've stopped the VI schedule). And in recent years, behavior analysts have started using the concept of *behavioral momentum* (essentially, resistance to disruption, like resistance to the response-frequency decreasing effects of electric shock, extinction, or satiation).

But remember the *error of reification*—the error of calling an invented explanation a thing. Well, soon after he introduced the concept of response strength, Skinner, himself, rejected it, realizing that response strength was a reification, like the circular reifications of traditional psychology of which he had been so critical, much like Freud's *ego* and *id* or perhaps *intelligence* and *personality*. Why is the person talking to so many people at the party? Because she has a gregarious personality. Why is the pigeon pecking the key so frequently? Because its key pecking has a high response strength.

Even if we say response strength does not cause the high frequency of key pecks, its reification nature can still create problems. For example, resistance to extinction is often said to measure response strength. And behavior analysts make a big deal out of the counterintuitive fact that intermittent reinforcement, for example a VI schedule, produces greater resistance to extinction (greater response strength) than does continuous reinforcement. So does that mean we should always use intermittent reinforcement when we want to build a strong response? Suppose we have two response keys in the Skinner box with concurrent schedules of reinforcement—a VI 1-minute schedule on one key and continuous reinforcement on the other. Does that mean the response of pecking the VI 1′ key will be stronger than the response of pecking the continuous reinforcement key, that is, the bird will peck the VI 1′ key the most? Some would think so, but they'd be wrong. Normally the bird will end up pecking the continuous reinforcement key almost exclusively. So extinction suggests that the response strength is stronger with VI 1′, and concurrent schedules suggest response strength is stronger on continuous reinforcement. Now we have two different measures of response strength that contradict each other. And that's one of the problems with reifications. When you have two different ways of measuring the same thing, that thing is probably a reification, and you should probably bag it; for one reason, because those two different measures may not agree. In other words, there's no such thing as response strength; it's an explanatory fiction. Instead, what you have is the frequency of response during extinction and relative frequency of two responses during a concurrent schedule. No response strength.

QUESTION

1. Illustrate the problems of the concept of *response strength*.

Notes

1 Ferster, C. B., & Skinner, B. F. (1957). *Schedules of reinforcement*. New York: Appleton-Century-Crofts.

2 Based on Skinner, B. F. (1948). Superstition in the pigeon. *Journal of Experimental Psychology*, *38*, 168–172.

PART XII

Complex Processes III

CHAPTER 22

Concurrent Contingencies

Behavior Analyst Certification Board 5th Edition Task List Items		
B-7.	Define and provide examples of automatic and socially mediated contingencies.	Throughout
G-14.	Use reinforcement procedures to weaken behavior (e.g., DRA, FCT, DRO, DRL, NCR).	Throughout

Example

BEHAVIORAL CLINICAL PSYCHOLOGY

Play vs. Self-Stimulation[1]

Jimmy, the Child With Autism—Part XVIII

Mae and her team of behavior analysis students from Big State University continued working with Jimmy, the child with autism, to help him live a better life. Jimmy could stay for hours in a room full of toys, ignoring them all; he would sit gazing with a fixed, glassy-eyed look or grimacing by drawing the corners of his mouth out and down (revealing his upper set of teeth), or waving his hand with his fingers outstretched in front of his eyes, or spinning his personal top, or vigorously and repetitively rubbing his eyes, nose, mouth, ears, or hair, or holding nonedible objects in his mouth, or rocking back and forth and side to side, or rolling his tongue, or clicking his teeth, or audibly swishing saliva in his mouth, or repetitively knocking his knees together, or tensing his whole body and shaking, or contorting his legs, or . . . Jimmy was a living catalog of pathological self-stimulatory responses (responses whose reinforcers consist of the sensory stimulation they produce, often called stereotypy). Jimmy was a heartbreaking sight. (Sometimes automatic reinforcement is a good thing; sometimes it's not.)

But Jimmy's awful appearance was only a small part of his tragedy. If Jimmy was like other children with autism, his high frequency of self-stimulation meant his prognosis was bad—probably he'd have these problems the rest of his life. On the other hand, if Mae and her team could reduce his self-stimulation, he might have a chance to acquire a more functional repertoire.

So the team set up an intensive intervention at the Rosa Parks Academy. Under Mae's supervision, Sue and Max first used food to shape appropriate play (i.e., socially acceptable play). They used a coloring book and toys that allowed Jimmy to fit geometric forms in their proper slots. After Jimmy had acquired a minimal play repertoire, they recorded his baseline of self-stimulation and appropriate play during forty-four 5-minute sessions. Jimmy self-stimulated 100% of the time and concurrently played approximately 13% of the time.*

Then they added a punishment contingency, and it was a rough one. Each time Jimmy self-stimulated, they would sharply say, "No!" and briskly slap or briefly hold the part of Jimmy's body involved in the self-stimulation. This punishment contingency** was supposed to be aversive for Jimmy, and it definitely was for Max. He flinched each time he had to slap Jimmy's hand. Jimmy had such a high frequency of self-stimulation that it was a full-time job for both Max and Sue to keep track of his behavior and punish the inappropriate responses. Sue worked with Jimmy's self-stimulation from the waist down and Max worked from the waist up.

* Note that because these two classes of behavior were concurrent (they occurred at the same time), we don't add 100% and 13% to get 113%.

** Note that this case is based on a 1974 article. Nowadays, using aversive control procedures of this sort is rare; in fact, at the practicum site where our students worked with children with autistic behaviors and values, they do not even use the word "No" to decrease inappropriate behavior.

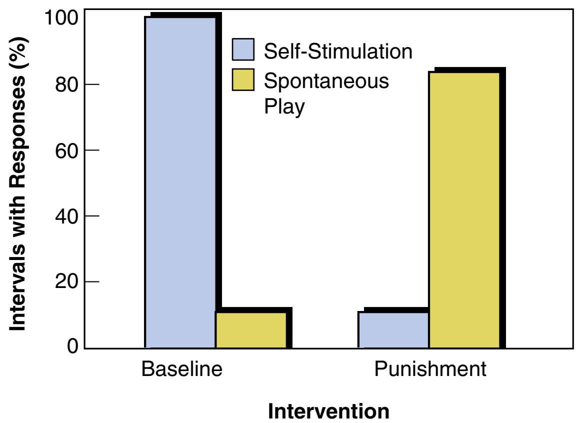


Figure 22.1 Increasing an Autistic Child's Play by Punishing Self-Stimulation

What were the results? Over fifty 5-minute sessions, Jimmy's self-stimulation dropped to a low of 13%, and his appropriate play increased to over 85% (Figure 22.1). In this one small area, at least, Jimmy was beginning to look and act like a typical child. Of course, they still had a long way to go.

Analysis

Jimmy had two reinforcement contingencies concurrently in effect for two response classes that were somewhat compatible—some forms of self-stimulation and normal play.

In other words, during baseline, he concurrently self-stimulated most of the time that he was playing normally. But in some other sense, self-stimulation was largely incompatible with normal play; when they punished self-stimulation, that class of responses, of course, became much less frequent, but at the same time, his normal play became more frequent.

We might look at it like this: Jimmy and some other children with autism don't really differ too much from typical children in terms of the reinforcers for normal play. When Jimmy had a chance to play normally, he did; the built-in reinforcement contingencies in normal play were effective. But, unfortunately, Jimmy's problem was that he didn't have much of a chance to play normally. Why not? Because his self-stimulation competed too well with his normal play. His self-stimulation didn't give his normal play much of a chance.

So the built-in sensory reinforcers for self-stimulation were too effective in reinforcing self-stimulation. And the built-in reinforcement contingencies in normal play weren't effective enough in reinforcing normal play. It was only when they added a third concurrent contingency—the punishment of self-stimulation—that self-stimulation was suppressed enough to give the reinforcers for normal play a chance.

Natural Contingency: *a contingency typically available prior to performance management*. It is not designed to manage performance. It is usually built-in or automatic, not added.

Performance-Management Contingency: *a contingency explicitly used to manage performance* when the natural contingencies are ineffective or when they move performance in the wrong direction.

Note: Don't confuse natural contingencies with unconditioned reinforcers. For instance, when Jimmy is disruptive, his parents pay attention to him and unintentionally reinforce his disruptive behavior. Their attention is a conditioned reinforcer, though the contingency is a natural contingency, as it existed prior to performance management and was not designed to manage Jimmy's performance. So both conditioned and unconditioned reinforcers and aversive conditions may be found in both natural and performance-management contingencies.

Inappropriate Natural Contingency

Before	Behavior	After
Jimmy has few sensory reinforcers.	Jimmy self-stimulates.	Jimmy has many sensory reinforcers.

Performance-Management Contingency

Before	Behavior	After
Jimmy receives no "no," brisk slap, or restraint.	Jimmy self-stimulates.	Jimmy receives "no," brisk slap, and restraint.

Appropriate Natural Contingency

Before	Behavior	After
Jimmy has no play reinforcers.	Jimmy plays normally.	Jimmy has play reinforcers.

QUESTIONS

1. Diagram the three contingencies involved in a behavioral intervention using punishment of self-stimulation to increase normal play.

2. Give an example where an inappropriate natural contingency is a conditioned reinforcer, not an unconditioned reinforcer.

Concept

CONCURRENT CONTINGENCIES

Concurrent means *at the same time*. So two things that are concurrent exist *at the same time*. That means **concurrent behavioral contingencies** are available at the same time. Notice I say *available*: They're sitting there waiting for you. But they may not be operating at the moment. For example, two contingencies are concurrently waiting for you if you jump out of the second-story window of your classroom building: First, there's the thrill of the rapid descent—a reinforcer, at least for bungee jumpers; then there's the pain of broken bones, an aversive condition for all but the most terminally weird. But that concurrent pair of contingencies lies dormant unless you actually jump. Just because behavior is specified in a contingency doesn't mean the behavior is actually happening. And that applies to other concurrent contingencies, too.

Remember Grace? She sometimes had an attack of the Tourette syndrome when she was in stressful situations, as when her family got rowdy.[2] Two different negative reinforcement contingencies were concurrently available there. First, when Grace displayed the pathological responses characteristic of her Tourette syndrome, she escaped the stressful situation. (This is not to imply that Grace was doing this intentionally—remember the thumb-twitch example of learning without awareness.)

Inappropriate Negative Reinforcement Contingency

Before	Behavior	After
Family is rowdy.	Grace swears, etc.	Family is not rowdy.

Or at the suggestion of Dr. Goldiamond and Dr. Glass, she could escape more appropriately. She could simply ask her family to quiet down, giving her medical condition as the reason for her request.

Appropriate Negative Reinforcement Contingency

Before	Behavior	After
Family is rowdy.	Grace requests less noise.	Family is not rowdy.

So the pathological negative reinforcement contingency involved the Tourette syndrome responses followed by the termination of the aversive commotion. And the concurrently available, healthy, negative reinforcement contingency involved a proper request followed by the termination of the aversive commotion. Again, understand that two contingencies are concurrent if they are *available* at the same time; they need not be actually operating at the same time. In other words, these two contingencies are concurrently available, even though Grace is not both swearing and requesting at the same time.

Also keep in mind that a contingency is an if–then statement. *If* Grace swears, *then* the family will stop being rowdy, but that doesn't mean that she will swear. *If* you jump off the building, *then* you'll break a leg, but that doesn't mean you have to jump.

Definition: CONCEPT

Concurrent contingencies

- More than one contingency of reinforcement or punishment
- is available at the same time.

Goldiamond also reported the case of Ralph, the smoking accountant. For Ralph, the pathological negative reinforcement contingency involved smoking a cigarette that allowed him a brief escape from his aversive paperwork. The concurrent, healthy contingency involved the responses of exercising or having a cup of tea that allowed him a brief escape from the aversive paperwork. For both Grace and Ralph, we have two different negative reinforcement contingencies, each involving a different escape response producing the termination of the same aversive condition.

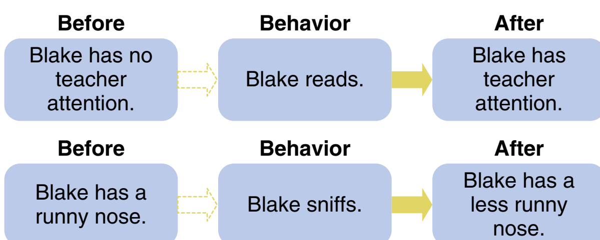
Concurrent contingencies also controlled Jimmy's behavior: During baseline, sensory stimulation was contingent on self-stimulation, and, concurrently, other stimulation, including sensory stimulation, was contingent on normal play. During intervention, Sue and Max added another concurrent contingency—aversive stimulation contingent on self-stimulation.

Four Types of Concurrent Contingencies

Note that our definition of **concurrent contingencies** suggests four types of concurrent contingencies:

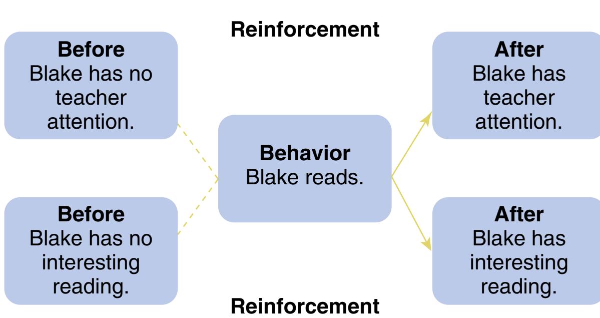
1. Contingencies may be available concurrently for two physically ***compatible responses***. The teacher may be reinforcing Blake's reading by giving him a little attention, and relief from a runny nose may be reinforcing his sniffing—two normally compatible responses because he can both read and sniff at the same time.

Compatible Behaviors



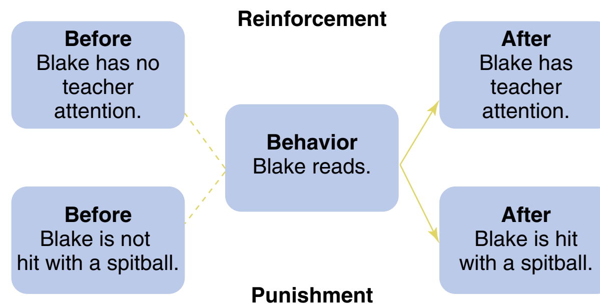
2. ***Compatible contingencies*** may be available concurrently for a ***single response***. The teacher may reinforce Blake's reading by paying attention to him, and also the interesting material might reinforce his reading—two compatible contingencies with a single response. These contingencies are compatible in that they both cause the response frequency to increase. Of course we could also have two compatible contingencies that were both punishment contingencies and both cause the response frequency to decrease.

Compatible Contingencies



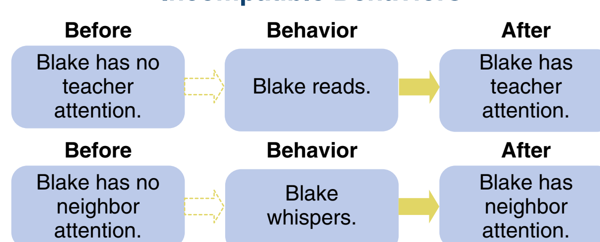
3. ***Incompatible contingencies*** may be available concurrently for a ***single response***. The teacher may reinforce Blake's reading, but a neighbor may throw a spitball every time Blake picks up the book—two incompatible contingencies with a single response. These contingencies are incompatible in that one causes the response frequency to increase, while the other causes it to decrease.

Incompatible Contingencies



4. Contingencies may be available concurrently for two physically ***incompatible responses***. The teacher may reinforce Blake's reading, and a neighbor may reinforce his whispering—two incompatible responses.[3]

Incompatible Behaviors



QUESTIONS

1. *Concurrent contingency*—define it and list and briefly give an example of each of the four types of concurrent contingencies, two types that are compatible and two that aren't.
2. Our definition of *concurrent contingencies* suggests four types of concurrent contingencies. What are they, and how would you diagram examples of them?

Example

VERBAL BEHAVIOR AND AUTISM

Concurrent Contingencies and the Factors That Interfere With Language Learning[4]

When Jimmy first came to the Rosa Parks Academy, he had no verbal skills (i.e., no language), and he had been given the label of autism. He couldn't tact (label), mand (request), and so on. He hadn't learned these verbal skills because the reinforcement contingencies were inadequate.

*Concurrent Reinforcement Contingencies for Alternatives to Verbal Behavior**

Contingencies for verbal behavior are the most obvious when it's first learned. Parents help to build a child's verbal repertoire by reinforcing many verbal responses. But you've seen that more than one contingency of reinforcement or punishment can be in effect at the same time. Sometimes the contingencies that come to control behavior actually interfere with learning verbal behavior. In general, three categories of concurrent contingencies interfere with language learning, as you will now see.

When contingencies reinforce alternative nonverbal behaviors instead of verbal behavior, the alternative behaviors increase in frequency. These nonverbal behaviors compete directly with verbal behavior.** The contingencies that would reinforce verbal behavior may be available at the same time as the competing, concurrent reinforcement contingencies, but the verbal-behavior contingencies lose out.

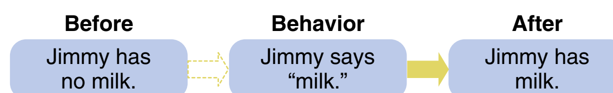
Disruptive Behavior as an Alternative to Verbal Behavior

Flash back to 18-month-old Jimmy: Jimmy toddles around the kitchen making happy baby sounds. He hasn't eaten yet today, and he's hungry. He begins to whimper. Jimmy's mother, Amy, picks him up and cuddles him. Jimmy cries. Amy puts him down and gives him his favorite toy. Jimmy begins to stomp his feet. Desperate, Amy asks Jimmy what he wants. Jimmy throws himself on the floor and pounds his fists. Finally, Amy gives him a bottle. Jimmy stops crying and drinks the milk. The opportunity is lost for an approximation to a verbal request (a mand) to be reinforced. Instead, Jimmy's disruptive crying is reinforced.

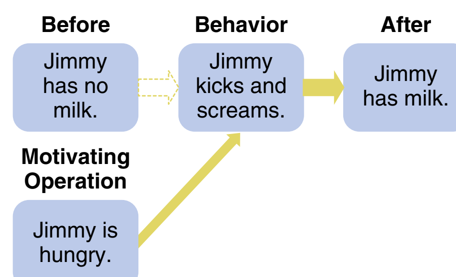
In Jimmy's case, the concurrent contingencies for the appropriate mand of saying "milk" and the inappropriate disruptive behavior are in effect at the same time—but the disruptive behavior is reinforced, so that is the behavior that increases.

When contingencies support disruptive behaviors, these behaviors prevent the occurrence of reinforced verbal behaviors.

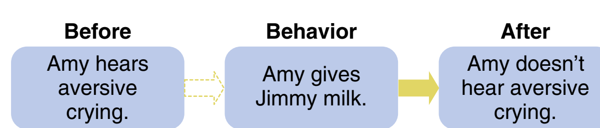
Reinforcement Contingency for Vocal Verbal Mand



Reinforcement Contingency for Disruptive Behavior



We can see how the reinforcement contingency for disruptive behavior maintains the incompatible response. But let's briefly digress to ask what maintains Amy's behavior of giving Jimmy milk when he tantrums. That's right—escape from Jimmy's aversive crying.



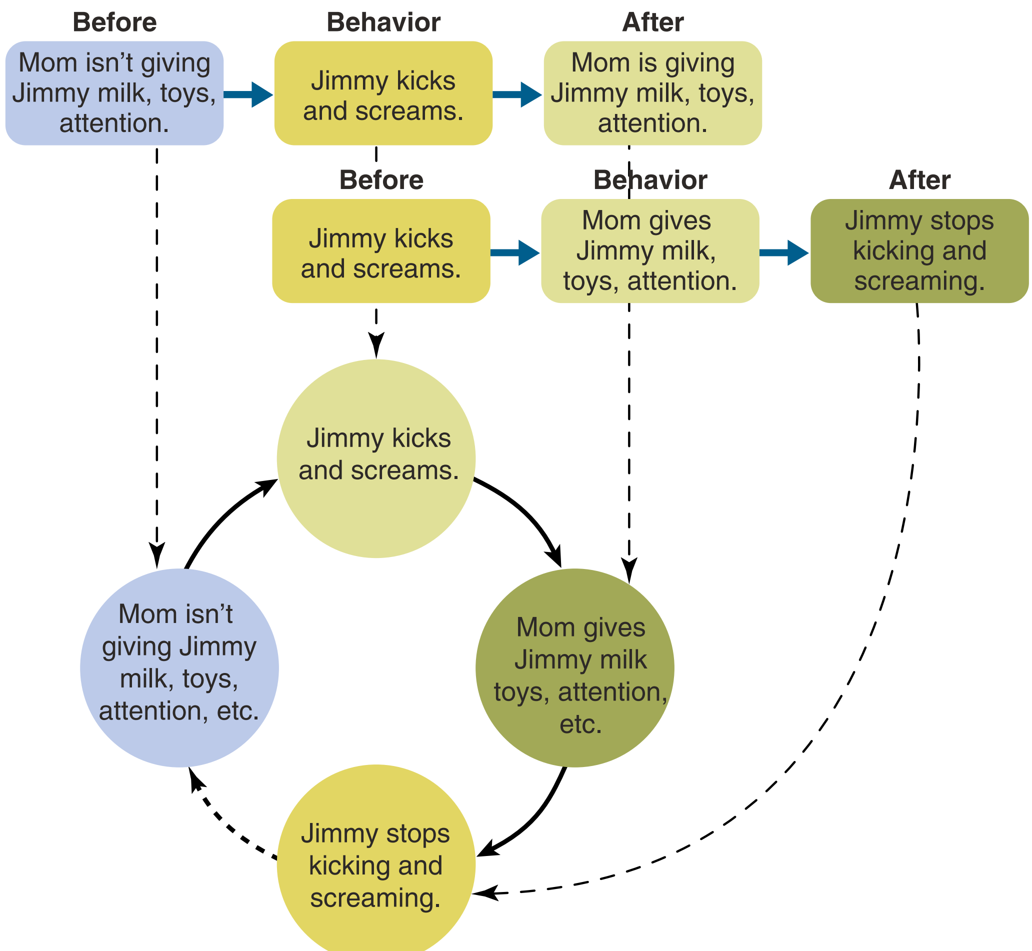
Amy is the victim in the sick social cycle.

Now, back to our main point: You've seen how disruptive behavior can be established as an alternative to verbal behavior. The disruptive behavior actually serves the same function as verbal behavior. But nondisruptive behavior can also serve as an alternative to verbal behavior.

* For purposes of illustrating these factors, we've packed them all into one fictional case study with Jimmy, though they might or might not all be operative in any specific real-life situation.

** We would even take this a little further, and say that reinforcing "simplistic" verbal behavior like pointing might interfere with "real" verbal behavior (talking or signing). Even though the Skinnerian definition of verbal behavior could include other modes of communication (like pointing) as long as they serve the same function, that isn't *really* what we mean by language and verbal behavior. If little Jimmy could get everything he wanted by pointing, he would probably not develop real language very quickly, if at all.

The Sick Social Cycle (Victim's Negative Reinforcement Model)



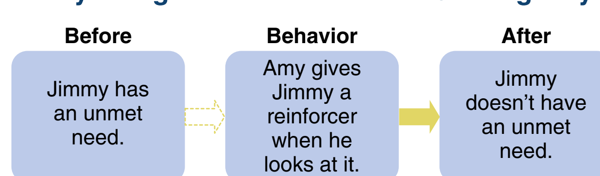
Nondisruptive Behavior as an Alternative to Verbal Behavior

Jimmy looked at a ball sitting on the shelf. Amy immediately gave it to him. Later, the ball rolled under the sofa. Jimmy stared after it, and Jimmy's cousin Jason got the ball and rolled it back to him. Amy smiled at the two boys. "Jason, you are such a good cousin," Amy said. Jason smiled.

Staring, pointing, and gesturing can function as nonverbal alternatives to verbal mands. When parents and family members reinforce nonverbal alternatives, the frequency of those alternatives increases. Unfortunately, they are incompatible with verbal mands.*

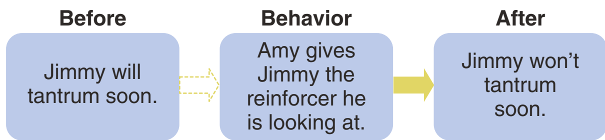
So, why did Amy reinforce Jimmy's nonverbal alternatives to mands? Perhaps for two reasons. First, it's aversive for most parents to think their infant has an unmet need. Second, she also avoided any tantruming that might have occurred if Jimmy didn't get what he wanted.

Amy's Negative Reinforcement Contingency



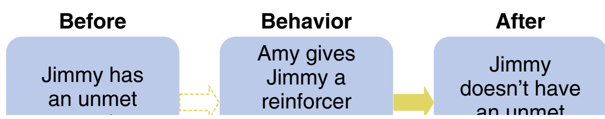
* Many behavior analysts consider pointing and gesturing to be forms of verbal behavior, nonvocal mands (requests). However, I think this debases the concepts of verbal behavior and language. I think it's best to consider such behavior as nonverbal alternatives to mands, just as we think Rudolph's lever presses are not verbal behavior, not language, not mands, and not requests that the experimenter give him a drop of water; instead Rudolph's lever press is simple behavior reinforced by the receipt of water, just as Jimmy's pointing to the cup of water is just simple behavior reinforced by the receipt of water.

Amy's Avoidance Contingency



Parents also tend to reinforce any behavior of other family members that results in a happy child, just as Amy praised Jason for retrieving the ball when Jimmy looked at it.

Amy's Negative Reinforcement Contingency



Note: We are *not* saying Amy is a bad mother. Amy is an excellent mother. But somehow, perhaps because of some little incident or a series of inconspicuous little incidents, Jimmy's behavior and values drifted in the wrong direction.

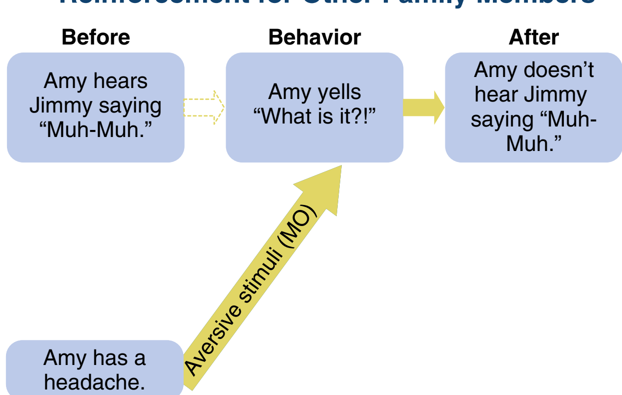
Suppression of Verbal Behavior by Punishment

Amy has a headache. Jimmy tries to get her attention. He says, "Muh, Muh, Muh" (his approximation to "Mama"). Jimmy's verbal response could be reinforced by Amy picking him up.

Instead Amy yells at Jimmy, "What is it?!"

Jimmy quiets. His verbal behavior has been punished. Sometimes adults accidentally punish children's verbal behavior instead of reinforcing it. This doesn't mean that the parents are "bad parents." Think of some of the loud, chatty 2-year-olds you know. Under some circumstances, their chatter can be very aversive. Parents may not intend to punish verbal behavior; they may simply react to aversive stimuli with unintended aggression.

Reinforcement for Other Family Members



Punishment contingencies that suppress verbal behavior may be in effect at the same time as reinforcement contingencies that support verbal behavior. (Now, we're not saying this will be a problem if a child's verbal behavior is only punished once in a while, but if Mama had a chronic headache, then the infant might be in serious trouble in terms of learning verbal behavior.) Concurrent contingencies are everywhere. In real life, there may be more concurrent contingencies than simple, isolated contingencies. And, as you can see, the concept of concurrent contingencies is very useful in helping us solve the mystery of why Jimmy and many other children fail to learn to talk.

QUESTION

1. What are the three categories of concurrent contingencies that interfere with language learning and what's an example of each?

TWO MORE FACTORS THAT INTERFERE WITH LANGUAGE LEARNING*

Two more factors interfere with language learning. They both have to do with the absence of learning opportunities. A ***learning opportunity*** is (1) an occasion for a response, (2) the response, and (3) an outcome of that response (essentially, a contingency). Though the absence of learning opportunities doesn't specifically involve concurrent contingencies, learning opportunities are essential to all learning and therefore deserve consideration when dealing with language learning. There are at least two reasons for the absence of learning opportunities; as we will now see, no one may be around to reinforce verbal behavior, or those who are around may not require verbal behavior.

No One Is Around to Reinforce Verbal Behavior

Amy puts 1-year-old Jimmy in his playpen and turns on the *Elmo's World* TV show. "Thank goodness for the annoying red puppet! How would I have time to fix dinner if I didn't have that TV?" She leaves the room.

Jimmy spots his stuffed Elmo, a big reinforcer. But does he attempt to mand (ask) for the Elmo? Probably not. That behavior isn't reinforced when he's alone. And if he spends most of his time alone in the playpen, he's not going to have enough learning opportunities to talk.

* This section is also based on the impressive theoretical analysis of language learning by Drash and Tudor we referred to earlier.

Even if Jimmy does happen to say some approximation to "Elmo" when Amy isn't in the room, saying *Elmo* won't be reinforced; so it will extinguish.

Probably, 1 hour of TV-induced extinction of mands, even 1 hour per day, would have little negative impact on a child's learning to mand. But if the child spends most of the day isolated from adult interaction, few learning opportunities will take place.*

When Parents Don't Require Any Verbal Behavior

When a child appears to be learning at a slow pace, parents may be convinced that their child has a physical or neurological disability even though none exists. Therefore, they may not require their children to produce *any* specific behavior in order to receive reinforcers. Then the child gets fewer learning opportunities. The fewer learning opportunities a child has, the more "delayed" he will appear to be. So, when parents lower their requirements of their children's behavior because their children seem to be delayed, they may actually perpetuate the problem.

Also, consider parents of children with illnesses or physical disabilities that have no direct effect on a child's verbal behavior (talking). Such parents may not require their children to talk because these parents fear causing further physical problems. For example, the parents of an asthmatic child may not ask their child to produce verbal behavior because they fear the "stress" might produce an asthma attack.

Punishment of Parents' Requiring Their Children to Make Verbal Responses

Before	Behavior	After
Parent doesn't fear child's worsened physical condition.	Parent requires child to make a vocal verbal request.	Parent fears child's worsened physical condition.

Sometimes, the previous factors may work in combination: Children don't spend enough time with attentive parents; and even when parents are around, they don't require and then reinforce verbal responses. Whatever the specific situation, the result is the same for the child: fewer learning opportunities, less learning, and less or no verbal behavior (language).

* The brilliant social critic, Chris Rock, has some insightful comments about the necessity of learning opportunities for language acquisition, though not in those terms.

QUESTION

1. What are two more factors that interfere with language learning?

BIOLOGICAL PROBLEMS THAT INTERFERE WITH LANGUAGE LEARNING

Sometimes a child's physical problems can influence the behavioral contingencies that affect language learning. This may sound like the medical-model myth, but it's not. You've learned that baby babble sounds like the language of the parents, because the parental sounds are conditioned reinforcers. And you've learned that children imitate the vocal verbal behavior of their parents, again because the parental sounds are conditioned reinforcers. But hearing loss hinders learning vocal verbal behavior, because parental sound is less likely to become a conditioned reinforcer. Of course, children with a hearing loss can still learn language, but often their language learning is delayed because they don't receive the special training they need early enough.

Although there are many impressive exceptions, most often, both professionals and parents make the circular-logical error of inferring a biological cause for a behavioral problem, even though there is no biological evidence for that biological cause. The error of reification. They blame it on the brain and then no longer feel responsible for finding the behavioral contingencies that most likely caused the problem and no longer feel responsible for finding the behavioral training contingencies needed to eliminate or at least reduce the language problems. (We're not implying that they're intentionally doing this brain blaming to escape the responsibility of doing the contingency search. Again, this could well be escape without awareness.)

QUESTIONS

1. How might hearing impairment affect a child's language learning?
2. Explain how some people commit the error of reification when looking for a cause for behavioral problems.

DINING OUT WITH CHILDREN—A DANGEROUS ACTIVITY, AT BEST, OR THE INVASION OF THE ANKLE-BITERS[5]

"Mae, I can't stand it anymore. Those two ankle biters are driving me up the wall," Juke said. "It sounded easy when my sister asked if I'd mind taking care of her two boys for 10 days, while she and her husband went to San Francisco for their second honeymoon. But those two brats have been here only 2 days, and already I want to ask my sister to cancel her honeymoon. I don't know who's worse, Rob or Roy—the 3-year-old or the 5-year-old."

"What happened to the coolest dude in town, the dude who can solve anyone's problems?" Mae asked. Every call from her boyfriend the past few days was about his new wards.

"Mae, I don't need someone else to bug me. I need someone to help me or at least give me some advice," Juke said.

"OK, why don't you and I and the two boys go out to dinner tonight," Mae said.

"That'll be just great, and we can watch Rob and Roy destroy the restaurant," Juke answered.

That night the foursome went to one of Juke's favorite restaurants, La Maison de Paris, and his prediction came true. The two boys were all over the place, standing on their chairs, running, hitting, kicking, crying, whining, demanding, humming, singing, hitting each other with their spoons, and interrupting Juke and Mae who were trying to have a serious conversation about what to do with the boys. All that occurred during the brief 20 minutes they waited for the waiter to serve the food. True, the boys did quiet down a bit when the food arrived, though both kids whined and said they wanted a Happy Meal and not "that thing" (Chateaubriand).

As they were driving home, Juke said, "From now on, I'm going to keep them locked in the guest bedroom and toss them a couple cold hot dogs every day!"

"Juke, that's not funny. Besides, I think we can solve the problem. I've read Ken Bauman's doctoral dissertation that he did down at Florida State University. I think he's got the solution."

Analysis and Intervention

Mae and Juke did borrow the intervention Bauman and the FSU team had developed and tested. We can look at this intervention largely as an effort to manage various concurrent contingencies.

First, let's consider the disruptive behaviors—running, hitting, and so forth. These acts don't occur out of the blue. They resulted from the boys' behavioral histories, from the past contingencies of reinforcement. Some of those contingencies involved the reinforcing attention of the parents (sometimes it's more reinforcing to be nagged at than to be completely ignored). Then there was the reinforcing reaction of the other brother (e.g., Rob's crying when Roy hit him). And there was the reinforcing sensory stimulation that results from acts like singing, pounding, jumping, and running.

So all these contingencies were available concurrently. Sometimes the reinforcing sensory feedback from Roy's pounding on the table would win out and control that pounding. Then maybe the stimulation from his pounding would lose its reinforcing novelty, and the reinforcement contingency involving Rob's crying might take over. The result would be that Roy pounded on Rob instead of the table. On and on, from one concurrent contingency to another, and from one disruptive behavior to another.

Inappropriate Natural Contingencies

Before	Behavior	After
Roy hears no audio stimulation.	Roy pounds the table.	Roy hears audio stimulation.
Roy gets no attention from adults.	Roy pounds the table.	Roy gets attention from adults.
Roy gets no sadistic thrills.	Roy pounds Rob.	Roy gets sadistic thrills.

These contingencies are *inappropriate* in that they reinforce inappropriate, disruptive behavior. To combat these inappropriate, disruptive contingencies, Juke added some concurrent performance-management contingencies of his own. He told the boys, in detail, how they were to behave or, more to the point, how they were *not* to behave: no running, no hitting, and so forth. In other words, he gave them the rules how to not act like brats. Now those rules implied that some new punishment contingencies were concurrently in effect. Juke's disapproval was contingent on their misbehavior. (At least Juke hoped his disapproval would be more aversive than his sister's had been.)

He also said, "I'll be really proud of you guys if you do not act like little brats." This implied what Juke hoped would be a concurrent reinforcement contingency.

And during the premeal wait, Juke gave them each a couple of small toys to play with—another concurrent contingency. He *hoped* they would be less likely to be disruptive like brats if they were engaged with their toys.

Concurrent Performance-Management Contingency

Before	Behavior	After
Roy has no good, clean fun.	Roy plays with his toy.	Roy has good, clean fun.

Now it's time for a brief reminder from Chapter 11:

Differential Reinforcement of Other Behavior (DRO)

- A reinforcer is presented after a fixed interval of time
- if the response of interest has *not* occurred during that interval.

Differential Reinforcement of Incompatible Behavior (DRI)

- Reinforcement is contingent on a behavior that is
- incompatible with another behavior.

1. So, with the help of that reminder, what was this concurrent performance-management contingency? Was it DRO or DRI? And why do you think that's the right label for the contingency Juke added? (This is assuming, of course, that the kids would be so involved with their toys that they couldn't be disrupted.)

And Uncle Juke added one more, very important, performance-management contingency: During the wait for the meal, he gave each of them a favorite cracker when they went for a little while doing anything other than acting like brats, or more to the point, when they weren't disrupting.

Concurrent Performance-Management Contingency

Before	Behavior	After
Roy has no cracker.	Roy does anything but act like a little brat.	Roy has a cracker.

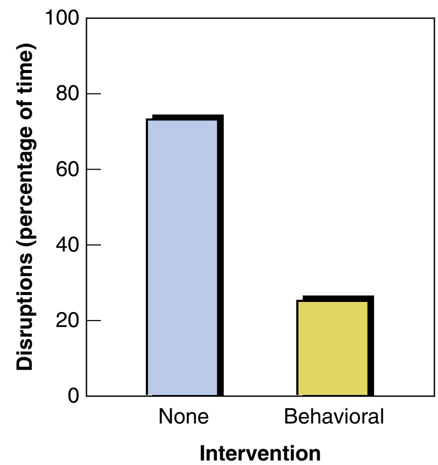


Figure 22.2 Children's Disruptions While Waiting for Dinner

2. What was this concurrent performance-management contingency and why do you say that?

a. DRO
b. DRI

Yeah, we know; that's a tough question because doing anything but acting like a brat is incompatible with acting like a brat, suggesting that this is DRI. But, because it's such a vague, general class of behavior and because it has to go for a period of time before it gets reinforced, it's called DRO.

Results

Always the scientific practitioner, Mae had recorded baseline data on the boys' behavior during the premeal interval of their first dinner. Then she recorded their behavior during the premeal interval of the next dinner; this was when Juke had started Bauman's intervention. Both boys showed such great improvement (Figure 22.2) that Juke was almost ready to marry Mae and start raising some kids of their own—almost, but not quite.

QUESTION

1. Diagram a behavioral intervention to decrease a child's disruptive behavior while waiting for dinner. Include

a. a few inappropriate natural contingencies
b. two concurrent performance-management contingencies

Example

Behavioral Child and Family Counseling

SHOPPING WITH CHILDREN—A DANGEROUS ACTIVITY, AT BEST[6]

Bauman's behavioral intervention so impressed Juke that he couldn't resist trying another behavioral intervention when he ran into similar problems on his shopping trips with Rob and Roy. (Rusty Clark and a team from the University of Kansas and the Johnny Cake Child Study Center developed this intervention.)

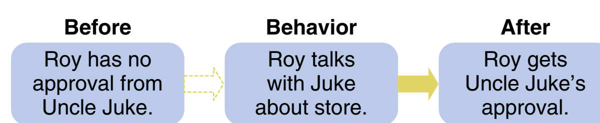
On their first trips, the boys were all over the store, handling everything that wasn't moving and some things that were, almost constantly asking the "buy-me?" question, and roughhousing. So Juke told them they'd each get $2.00 to buy something at the end of the trip, if they were cool. And he defined cool in terms of doing anything that wasn't in a list of uncool moves he read to them. In other words, Juke used a special differential reinforcement contingency, reinforcing anything other than uncool behavior. So there you've got a pair of concurrent reinforcement contingencies: One is a natural reinforcement contingency, the built-in and social reinforcers for misbehavior. The other is a positive reinforcement performance-management contingency, reinforcement of all behaviors that weren't misbehavior (uncool), differential reinforcement of other behavior (DRO), all behavior other than misbehavior.

But a problem with the DRO contingency is the length of time during which the other behavior must occur before the boys would get their DRO reinforcer, like the duration of the entire shopping trip. So woops, there goes the 60-second rule! But smart Juke supplemented that DRO contingency with a negative punishment contingency: Whenever a boy misbehaved, Juke told him he wouldn't get a quarter he'd otherwise have gotten.*

And Juke did even more. He also kept up a running conversation with the two boys about what they were doing in the store. For example, he'd ask them where they thought they could find what they were looking for, often after he'd gotten them within sight of the object. They'd discuss the price and quality of the item. They'd talk about what they were going to do with the object. Also, they'd discuss interesting merchandise as they passed along. At the end, he'd ask them where the toy or candy department was, and they'd cash in on the remains of their two dollars. Of course, he kept up a high rate of approval for their taking part in the discussion.

Here, Juke was adding another set of reinforcement contingencies to the salad of concurrent contingencies. This added contingency would succeed in reducing disruption to the extent that talking to Juke about the shopping trip was incompatible with disruptive behavior. Those reinforcement contingencies involved the reinforcers that are naturally built into an interesting conversation, as well as Juke's frequent approval.

Concurrent Performance-Management Contingency



This Uncle-Juke's-approval contingency is an attempt at differential reinforcement of incompatible behavior.

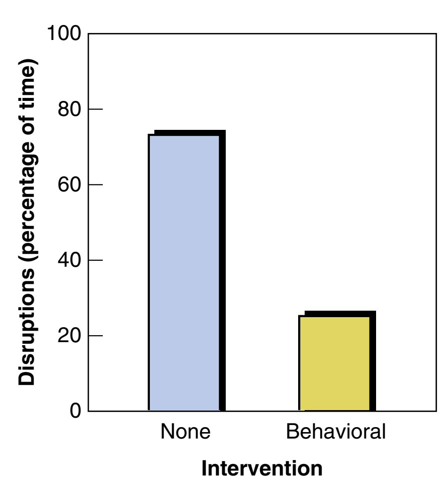


Figure 22.3 Children's Disruptions While Shopping

* As we pointed out in Chapter 11, we think DRO contingencies are really punishment by the prevention of the presentation of a reinforcer. But we want you to also learn how to use the DRO terminology as most behavior analysts and the BACB view it. But if you want to be hyper-hip, you'll look at Juke's "DRO" contingency and interpret it as punishment by prevention of a reinforcer.
And as we pointed out in Chapter 3, when the reinforcer delivery breaks the 60-second rule, we've really got *rule-governed analogs to reinforcement*; this is really an analog to DRO. And we'll hit on rule-governed analogs a lot more in Chapters 25 and 26.

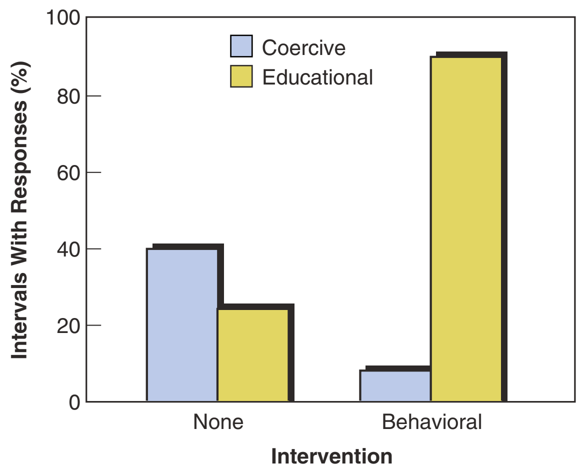


Figure 22.4 Reducing Coercive Comments and Increasing Educational Comments

Note that these conversations served two functions: They reinforced behavior that was more or less incompatible with disruptions, and they served to educate the boys about proper consumer behavior and the world of shopping malls.

Did Rusty Clark's behavioral intervention work? Of course. The boy's disruptive behavior and comments immediately fell from 79% to 14% (Figure 22.3). Mae commented that with Rusty's behavioral intervention the boys were now better behaved than Juke normally was when they went shopping. Juke made no comment.

How did the boys feel about this? In other words, how was the social validation? The boys liked it. And why not? They each lost no more than 50 or 75 cents. Also, Juke wasn't on their case as much as he had been before. During baseline, he'd nagged, shouted, reprimanded, and coerced them 43% of the time. But during his behavioral intervention, he bugged them only 9% of the time. That's not all; his frequency of educational comments rose from 25% to 91% of the time (Figure 22.4).

How'd Juke feel about it? What were his social validation data? He said it was more work than before but well worth it. Besides, it cost him an average of a couple bucks per boy less on each trip. Saving money wasn't Uncle Juke's goal, but still . . .

QUESTION

1. Diagram the performance-management contingencies to decrease a child's disruptive behavior while shopping.

Example of Concurrent Contingencies

Behavioral School Psychology

EARL, THE HYPERACTIVE BOY[7]

Earl's parents and grandparents had beaten him so cruelly that, by the time he was 1 year old, he had a fractured skull and a damaged brain. Loving foster parents adopted Earl when he was 3. But it may have been too late; Earl couldn't adjust to the normal demands of the world. By the age of 9, he was still in the second grade and always in trouble. He spent almost no time studying; instead, he talked, looked around the room or stared out the window, tapped, squirmed, fiddled, and wandered about. He played with his classmates by pushing them, pinching them, hitting them, and throwing himself into their midst—disrupting their work and play. He'd even shove his desk around the classroom, ramming into everything that couldn't move fast enough to escape. And because he was 2 years older than his classmates, he was big enough to bully them all.

Inappropriate Natural Contingencies

Before	Behavior	After
Earl hears no interesting sounds.	Earl taps.	Earl hears interesting sounds.

Before	Behavior	After
Earl sees no interesting sights.	Earl trots to the window for a peep.	Earl sees interesting sights.
Earl gets no attention.	Earl blurts out.	All eyes and ears are on Earl.
Earl hears no interesting squeal.	Earl pinches a classmate.	Earl hears an interesting squeal.

So all sorts of natural classroom contingencies maintained all sorts of disruptive behavior.

The school administrators called in Dr. Gerald Patterson from the Psychology Clinic of the University of Oregon. Gerry Patterson knew the following general rule: The ***action rule***: *To change behavior, use action, not words.*

In fact, he helped discover it. He knew traditional ways don't work. He knew it wouldn't help just to bring the child into his office for a little psychotherapy in the form of a few chats. Instead, Gerry went to where the problem was—the classroom. These were times for action, not words. It was time for the M&Ms.* Gerry put a small box on Earl's desk. The box contained a light bulb and an electromechanical event counter, a device that looks like an odometer in a car. Gerry told Earl he could earn candies and pennies by paying attention to his schoolwork. Here was the rule: At the end of each 10-second period, if Earl had paid attention to his work for the whole time, the light would flash and the counter would click another count. Then, at the end of each session, Earl would get as many M&Ms or pennies as the counter had counted—in other words, one reinforcer for every 10 seconds of work. Each daily session lasted from 5 to 30 minutes, so Earl could end the day a wealthy or a full 9-year-old, and better educated, too.

Concurrent Performance-Management Contingency

Before	Behavior	After
In 10 seconds, Earl will lose chance to get a light flash and counter click.	Earl studies continuously.	In 10 seconds, Earl won't lose chance to get a light flash and counter click.

The flash and click had become conditioned reinforcers because of the verbal analog pairing procedure with the delayed presentation of the M&Ms and pennies—Gerry had verbally paired them by telling Earl about the end-of-session exchange.

And what about the other kids? Wouldn't they get jealous of Earl's special privileges? Our experience suggests not. They understand, as well as we do, that a kid like Earl needs special help. They seemed happy to see Earl get that help, especially if that kept him off their backs. But Gerry Patterson took no chances; he brought the classmates into the game, too. He told them they would get a share of Earl's new wealth, and the less they bugged him, the more of that wealth he'd have to share. One result of this teamwork was that at the end of each session Earl's classmates would break into applause when the teacher announced Earl's daily score. And they often walked by his desk to check his score and send some social approval his way, no doubt reinforcing his studying.

* Of course, sometimes a few words can be as effective as a lot of action—for example, when someone shouts, "Fire!" And sometimes we behavior modifiers use action when a few words would obviously be the intervention of choice. But most often, in traditional talk psychotherapy, for example, people make the mistake of trying to get rid of problem behaviors simply by discussing them when action is called for—when a change in the contingencies of reinforcement and punishment is called for.

Before the intervention, Earl had been spending 25% of his time disrupting the class; but by the end of Gerry's help, Earl was down to less than 5%—about average for most typical kids. In fact, during one 2-hour session, he was the most studious student in the class. He was also less unruly and destructive on the playground, actually playing with the others rather than tormenting them. Within 4 months, Earl had friends visiting him at home for the first time in his life. And he was making progress in his remedial reading program.

This study impresses us. It shows how you can get almost any behavior under control if you do what it takes. The problem is, most people don't do what it takes. Most people settle for pinning a label on a kid so they can write him off. The label they pinned on Earl was "hyperactive," which, roughly translated, means "a person who horses around so much they're a pain in the rear." Fortunately, some behavior analysts like Gerry are so dedicated to helping people that they do go to the extreme of delivering a reinforcer every 10 seconds, if it takes that to save a kid.

Concept

DIFFERENTIAL REINFORCEMENT OF INCOMPATIBLE BEHAVIOR

Analysis

Let's look again at "hyperactive" Earl. Reinforcement contingencies were concurrently available for two physically incompatible response classes. The first class of responses was the disruptive responses; commotion and attention reinforced those responses. The second class of responses was studying; social approval, the flash of light, and click of the counter reinforced those responses. (The actual candy and coins probably came too late to reinforce that set of responses; the same with the applause after the teacher announced Earl's daily score.)

The procedure Gerry Patterson used was our old friend from Chapter 11, **differential reinforcement of incompatible behavior (DRI)**, where reinforcement is contingent on a behavior that is incompatible with another behavior.

To decrease Earl's disruptive behavior, Gerry used DRI, differential reinforcement of behavior physically incompatible with disruptive behavior—he reinforced continuous studying. The two classes of behavior were physically incompatible in that it was more or less impossible for Earl to study continuously and disrupt at the same time. Gerry reinforced continuous studying with a contingency involving positive reinforcement. This contingency was more reinforcing than the contingencies reinforcing disruption. So, as the duration of the incompatible behavior (studying) increased, the frequency of the undesirable behavior decreased.

Notice that Gerry didn't select just any old incompatible behavior. He selected incompatible behavior of value. So not only did he decrease Earl's disrupting, he also increased Earl's studying. Gerry got a two-fer.

By the way, we also can look at some other concurrent contingency interventions as involving differential reinforcement of incompatible behavior. For example, Jimmy's self-stimulation was generally physically incompatible with his normal play. So the natural, built-in reinforcement contingencies for his self-stimulation were differentially reinforcing behavior incompatible with his normal play. In other words, differential reinforcement of incompatible behavior does not always require that a performance-management contingency of a professional behavior analyst be involved; sometimes the everyday environment differentially reinforces behavior (self-stimulation) incompatible with other behavior (appropriate playing).

QUESTION

1. Using the concept of concurrent contingencies for physically incompatible responses, describe a behavioral approach to decrease hyperactivity.
    a. Diagram one of the inappropriate natural contingencies.
    b. Diagram the concurrent performance-management DRI contingency. (Hint: Remember that the outcome is not DRI with M&Ms and pennies; it's something more immediate.)

Compare and Contrast

DIFFERENTIAL REINFORCEMENT OF INCOMPATIBLE BEHAVIOR VS. DIFFERENTIAL REINFORCEMENT OF ALTERNATIVE BEHAVIOR

Inappropriate Natural Contingency

Gerry didn't do a functional analysis to determine the reinforcers maintaining Earl's disruptive behavior; so, in the diagrams of the preceding section, we filled in the gap with a few plausible guesses such as auditory, visual, and social reinforcers. But let's consider another possibility: Suppose all that disruptive behavior was maintained by teacher attention—that is, every time Earl disrupted, the teacher scolded him. No doubt the teacher would have assumed that the scolding was aversive and that scolding disruption was a punishment contingency, but often any form of attention in the classroom seems to be the reinforcer maintaining the disruptive behavior.

Performance-Management Contingency

Now let's look at a hypothetical alternative (not what Gerry actually did). Suppose the teacher had paid a little attention to Earl with a pat on the shoulder or a "good boy" whenever he studied for 10 seconds. The teacher would be using more or less the same reinforcer—attention—that had reinforced Earl's disruptions, except now the attention would be reinforcing a more appropriate, alternative behavior—studying. This is a special form of differential reinforcement called **differential reinforcement of alternative behavior (DRA)**—*withholding reinforcement for an inappropriate response, while providing reinforcement for an appropriate response* (Chapter 11).

Studying is incompatible with disrupting, just as was shown in the previous section, except now it produces the same reinforcer as we assumed disruption produced. Differential reinforcement of alternative behavior will work best if we are actually extinguishing the inappropriate behavior at the same time—in this case, if the teacher stops paying attention to Earl's disruptions.

So DRA and DRI are comparable in that they may both involve concurrent contingencies for two different responses—the desirable response and the undesirable response. They contrast in that, for DRA, the reinforcer for the alternative, desirable response is always the same as the reinforcer for the original, undesirable response; and the original and alternative responses are not always incompatible. However, for DRI, the original and the alternative responses are always incompatible, and the reinforcers for the incompatible responses are usually different.

How do we decide which differential reinforcement procedure to use? We use DRA when we want the person to be able to get the same reinforcer, but the behavior that currently produces that reinforcer is inappropriate or harmful. So we teach an alternative appropriate response that will produce that same reinforcer. And we use DRI when our primary concern is getting an inappropriate behavior to stop, and we don't care if the person can access the particular reinforcer that was maintaining that inappropriate behavior. So in this case, we introduce a new powerful reinforcement contingency for a behavior that is incompatible with the inappropriate behavior. And we'll use a reinforcer we think is powerful enough to overcome the original reinforcement contingency.

QUESTION

1. Use a pair of similar examples to compare and contrast DRA and DRI.

Controversy

SYMPTOM SUBSTITUTION

Sid's Seminar

Tom: You behavior analysts have one big problem: You always treat the symptom; you don't treat the underlying mental illness. You always treat the sign of the problem, not the underlying problem itself.

Joe: The old medical model. Here we go again.

Tom: You can call it the medical model if you want, but your superficial behavioral approach often fails. You treat only the symptom, not the underlying mental illness. And sure enough, another symptom crops up. The new symptom of the mental illness takes the place of the old one you've gotten rid of.

Sid: Interesting issue. But I also think you're talking from the point of view of the medical model. How did we define it?

Max: The medical model is a view of human behavior that the behavior is a mere symptom of an underlying psychological condition.

Joe: The amazing Max—word for word from Chapter 5—and he didn't even peek at his book.

Eve: When behavior is a problem, the medical model suggests that the underlying condition is an illness or a disease. The problem behavior is just a symptom that reflects the underlying mental illness.

Tom: Right. And you should treat the disease, not the symptom. You shouldn't just get rid of a particular problem behavior. If you do, the disease will substitute another one in its place. It's like treating a sick person's temperature and thinking you've cured the person.

Definition: ERRONEOUS PRINCIPLE

Symptom substitution myth

- Problem behaviors are symptoms of an underlying mental illness.
- So if you get rid of one problem behavior ("symptom"),
- another will take its place,
- until you get rid of the underlying mental illness.

Sid: I think there are two questions here:

- Does it ever happen that when you get rid of one problem behavior, another takes its place?
- And if so, what does that say about the behavioral approach to psychology?

Tom: It does happen, and that says the behavioral approach is too superficial.

Joe: What's bringing on this latest attack of mindless mentalism?

Tom: I'll tell you what. Max and Sue have been doing their practicum with Dr. Mae Robinson. And they've been working with a kid with autism, Jimmy, who's into self-stimulation. They finally got rid of one form of self-stimulation, and now Jimmy just substituted another one.

Sid: A good example of the problem.

Tom: A perfect example. As soon as they suppressed one form of self-stimulation, another form substituted for it. The behavioral approach neglected the underlying mental illness.

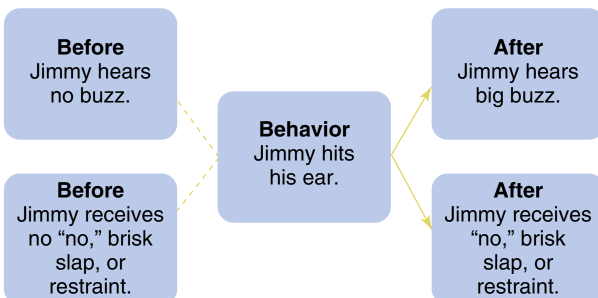
Sue: I think just the opposite. I think a behavioral interpretation of those results makes more sense. I like the interpretation in terms of concurrent schedules of reinforcement for competing behaviors. Sensory stimuli reinforce behavior. So we suppress one behavior that produces one sensory reinforcer. And that leaves the field open for another, less powerful sensory reinforcer to reinforce another behavior.

Joe: Like, if one movie is full, you go to your second-choice movie. But you wouldn't call it symptom substitution. And you wouldn't suggest it reflects an underlying mental illness.

Sue: The same thing applies to self-stimulation. It isn't a symptom of an underlying illness. It's just the behavior that normally occurs when no other stronger contingencies concurrently reinforce competing behavior.

Max: Besides, they did manage to suppress all the various self-stimulatory behaviors, in spite of their accompanying sensory reinforcers. And then another concurrent reinforcement contingency took over, the contingency supporting what we consider normal, healthy play. First you added a concurrent punishment contingency to the natural contingency reinforcing his ear hitting.*

Inappropriate Natural Contingency



Performance-Management Contingency

Max: And Jimmy stopped hitting his ear. Then you added the concurrent punishment contingency to the natural contingency reinforcing eye pressing.

Appropriate Natural Contingency

Max: And Jimmy stopped pressing his eyes. Then the appropriate natural reinforcement contingencies for normal play could take over.
Max: The results were that Jimmy started playing normally.

Sue: So why do mentalists make such a big deal out of symptom substitution?

Sid: I think mentalists are not so much concerned with the practical issue of the success of any particular behavioral intervention. Instead, I think they're concerned with a theoretical issue. They're trying to disprove behaviorism. They're offering symptom substitution as proof that behavior is caused by some underlying mental condition and not the environmental contingencies of reinforcement and punishment—the bread and butter of behavior analysis.

Tom: Are you saying symptom substitution doesn't exist?

Sid: Yes, "symptom substitution" does not exist. I agree that if you get rid of one problem, another one sometimes makes an appearance. But most behavior analysts would think it's a mistake to call that symptom substitution. We think the occurrence of the new behavior does not prove that the two behaviors are symptoms of anything, especially an underlying mental illness. They're just behaviors under the control of concurrent contingencies of reinforcement and punishment. I think that's the most straightforward analysis.

Joe: In other words, though the authors of our book are including *symptom substitution* as a technical concept, they're not suggesting it is a behavioral concept, nor is it an explanation they support. It's an erroneous concept.

Max: Let me add a postscript to this debate. Remember the section *Play vs. Self-Stimulation*? It points out that when we got rid of Jimmy's dysfunctional self-stimulation, he increased his frequency of "normal" play. Now surely you wouldn't call that symptom substitution!

Eve: Let me add a postscript, too. We should keep in mind that two contingencies may be concurrently present, though one contingency is not making contact with the behavior at the moment because the behavior isn't occurring. That also means that contingency is not visible at that moment. For example, Jimmy's play contingencies were present, though he wasn't playing. If he had started playing, their presence would have just been more apparent, that's all.

Sid: But as the authors said in Chapter 5, "This doesn't mean behavioral problems don't sometimes result from underlying biological problems—for example, brain injury or Down's syndrome." But we don't want to be like those traditional psychologists who misuse the medical model by inventing underlying mental illness as causes of observable problem behavior.

One of my students pointed out that functional assessment deals very well with the problem of symptom substitution. Using functional assessment, the behavior analyst can get a good idea of the reinforcement contingency maintaining the dysfunctional behavior. That contingency is often a negative reinforcement contingency where the dysfunctional behavior (e.g., a tantrum or aggression) removes an aversively

* These contingencies are just slightly different ways of diagramming the comparable one for Jimmy early in this chapter.

demanding task, like some discrete-trial-training tasks; or sometimes it's a social-reinforcement contingency, where the dysfunctional behavior gets attention from others. It can also be controlled by other positive or negative reinforcement contingencies, like access to candy or toys.

And rather than using a punishment contingency to suppress the dysfunctional behavior, as was done with Jimmy, nowadays behavior analysts are more likely to extinguish the dysfunctional behavior and differentially reinforce more appropriate alternative behavior. For example, they would establish a more appropriate response that would allow the child to escape the aversively difficult task; and they would probably also modify the task so that it produced a higher frequency of reinforcement for on-task behavior.

Two Views of One Behavior Automatically Replacing Another

Questions	Mentalistic Medical Model	Behavior Analysis
Does one problem behavior replace another?	Always	Sometimes
Does appropriate behavior replace problem behavior?	No comment	Sometimes
What causes behavior replacement?	An underlying mental illness	Concurrent contingencies of reinforcement
What's the implication?	Behavior analysis is too superficial	Keep working until you've dealt with each of the concurrent contingencies

In Jimmy's case, presumably a functional assessment would show that the dysfunctional behavior was automatically reinforced by stimuli it produced. So the behavior analysts might extinguish the self-stimulating behavior (blocking the initiation of that behavior by preventing Jimmy from completing the movements that would produce the stimulation). At the same time, they might differentially reinforce incompatible behaviors with reinforcers that would be more powerful than the self-stimulation.

QUESTIONS

1. *Symptom substitution*—define it and give a presumed example.
2. What's a behavior-analytic approach to Jimmy's various self-stimulation behaviors, as opposed to a symptom-substitution approach?
3. What theoretical implications does behavioral analysis have for the debate between the mentalistic medical model and a behavioral approach?
   Hint: Student, know thy tables.

Example

CONCURRENT CONTINGENCIES: ASLEEP AT THE KEYBOARD

Twelve A.M. For the last 5 hours, Sid had been at his computer—doing what? Writing his dissertation? No, that's what he was supposed to do. Instead, he was having a computer orgy, a computer pig-out, an activity he found to be a bigger reinforcer than almost anything else. Facebooking!

At that moment, he was "chatting" via Facebook with 15 other behavior analyst computer degenerates from as far north as Victoria, British Columbia, as far South as Caracas, Venezuela, and as far east as Tokyo, Japan. They were debating whether sleeping was behavior and whether the principle of reinforcement applied to it.

Sid's chin gradually sunk to his chest. Then his head jerked at the sound of a beep from his computer. He opened his eyes and looked at the computer screen. The little finger on his left hand had written "zzzzzzzzzzzzzz." Beneath his message was a message from a friend at The Ohio State University that read, "Sid, your 'zzzzz's' in response to my message are in poor taste."

"Just kidding," he typed back, lying through his fingers. Eyes closed. Chin moved slowly down. Then a quick shake of the head and the eyes opened. Sid loved these debates with his buddies, and he didn't want to miss a thing. But now the messages were flying across his screen so fast he couldn't have kept up even if he'd been fully awake. Still he hung in.

2:20 A.M. And still struggling.

2:21 A.M. Down for the count; slouched in his chair.

2:31 A.M. The computer screen flickered and then automatically went to sleep after 10 minutes of no responses from Sid. Maybe man and machine are not so different.

7:10 A.M. A kiss on the lips, a hand through the hair, and a voice in the ear: "Poor Sid, you must have worked all night on your dissertation. Here you are asleep at your computer. But you've got an 8:00 A.M. appointment."

8:06 A.M. Sid rushed into the psych building, Skinner Hall.

Analysis

Question

What's the difference between closing your eyes (a step toward going to sleep) when writing a dissertation and closing your eyes when chatting with the gang?

Answer

Two hours and 21 minutes. On Monday when he was chatting with the gang on Facebook, Sid made his final go-to-sleep eye-close response at 2:21; but on Tuesday when he was writing his dissertation, he made that go-to-sleep response at 12:00. In other words, he stayed up 2 hours and 21 minutes later on Monday. Why?

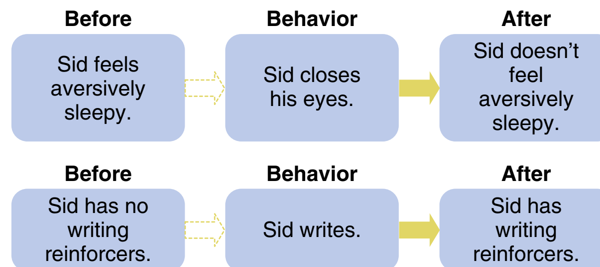
Well, we can look at these episodes as concurrent contingencies of reinforcement for physically incompatible responses or as incompatible contingencies on the same response.

Concurrent Contingencies of Reinforcement for Physically Incompatible Responses

In writing the dissertation, several concurrent contingencies might have been available. As Sid progressed in his writing, the reinforcers of intellectual stimulation and success might have reinforced this writing. Also, as he progressed, a slight reduction in the fear of failing to graduate might have reinforced his writing. But at the same time, the intellectual effort involved might have punished that writing.

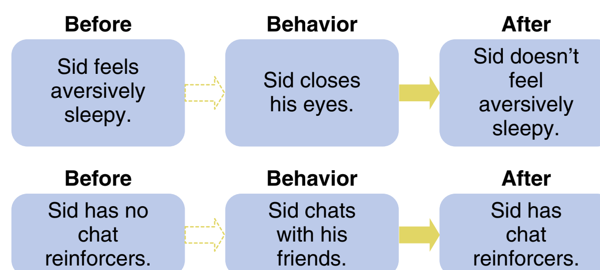
Also, at the same time, reinforcement by the removal of the aversiveness of being sleepy reinforced his closing his eyes. And, try as he might, Sid could not both sleep and write at the same time. So by the time the clock in the lower-right-hand corner of his computer screen read 12:00 A.M., sleep had won the night—a triumph for reinforcement of an incompatible response by negative reinforcement from the increasingly aversive condition of sleepiness.

Incompatible Behaviors



The contingency (or set of contingencies) that reinforced Sid's computer chatting with his friends was more powerful than those that had supported writing. So chatting held out a little longer than writing had against the negative reinforcement contingency that reinforced his closing his eyes.

Incompatible Behaviors



QUESTION

1. In terms of concurrent contingencies of positive and negative reinforcement for physically incompatible responses, diagram the problem of staying awake when you're working vs. when you're playing (e.g., doing academic writing vs. chatting with friends).

Research Methods

INTERVENTION (TREATMENT) PACKAGE (B-10)

Behavioral Science

Much of science consists of analysis. In fact, our approach to the study of behavior is even called behavior analysis.

What does *analysis* mean? An examination of the parts to find their essential features. In science, *analysis* often means an examination of the various variables to determine (find out) which are the independent variables (which factors cause the results we're getting). As we've seen, both the experimental analysis of behavior and applied behavior analysis involve careful experimental designs in which we hold all potential independent variables constant so we can measure the extent to which a single independent variable affects our dependent variables. If we try to vary more than one independent variable at the same time, we risk confounding the effects of one variable with another.

Providing Behavioral Service

However, remember Juke and Mae's use of Ken Bauman's intervention to reduce the hassle of dining out with kids? Neither they nor Ken Bauman did any analysis to determine the crucial independent variables. Instead, they threw in everything but the kitchen Cuisinart to get the two nephews to behave. They varied at least seven independent variables at the same time: (1) Juke gave them the rules of gentlemanly conduct. (2) He said, "I'll be real proud of you guys if you act like little gentlemen." (3) He sat them next to the wall. (4) He sat them on separate sides of the table. (5) He removed their silverware until the dinner arrived. (6) During the wait for the meal, he gave each of them a favorite cracker when they were being gentlemanly. (7) He gave them each a few small toys to play with.

Does this mean Juke, Mae, and Ken are poor scientists? No. They weren't trying to do science. They weren't trying to determine which of their various independent variables kept the kids from climbing the walls. They didn't have time for that sort of analysis (it wasn't economical). Juke and Mae were *providing behavioral services*. They were trying to provide behavioral services that would achieve a specific result—cool kids. To do this they changed several independent variables at once. In other words, they used what behavior analysts often call a **treatment package** (we prefer **intervention package**, to avoid implying the medical model).

Usually when we're providing behavioral services in applied settings, we're hired to achieve specific results rather than to do scientific analyses. To do a detailed, scientific, applied behavior analysis of the independent variables might cost too much in terms of time and money. In those cases, it's often more economical simply to use an intervention package.

Definition: CONCEPT

Intervention (treatment) package

- The addition or change of several independent variables
- at the same time
- to achieve a desired result,
- without testing the effect of each variable individually.

However, sometimes, it might be more economical to evaluate the effects of each individual independent variable, rather than to combine them all in one intervention package. For example, *we might want to evaluate the individual effects of some independent variables if their use were expensive and we anticipate repeated future use*. Suppose, in addition to the seven independent variables we've already listed in Bauman's intervention package, an eighth independent variable involved a computerized monitoring and feedback system that cost $200 per hour to use. You can be darned sure it would be economically wise to evaluate that component independently. But sitting the two kids on the opposite sides of the table doesn't cost that much.

Of course, whether or not we use an intervention package, we still have to evaluate our intervention empirically. We still want to determine if we've gotten the results we expect.

TECHNOLOGY DEVELOPMENT

What about Bauman and his crew? Were they doing applied behavior-analytic research or providing a behavioral service? Probably something in between. They were *developing technology*. They were developing and empirically demonstrating behavioral technology effective in achieving desired results. Their goal was not to do a behavioral analysis of each individual independent variable involved in that technology. Again, we might want to evaluate only the individual effects of some independent variables if their use was expensive and we anticipated repeated future use.

When Should We Use Intervention Packages?

Basic Science	Never or rarely; we don't want to risk confounding our independent variables.
Technology Development	Sometimes we just evaluate an intervention package when the components may not be worth analyzing individually. But, if some components are expensive and will be used repeatedly, then we need to evaluate them individually.
Providing a Behavioral Service	Usually we use an intervention package because we just need to get good results and can't afford to evaluate each component, unless some of those components are expensive and will be used repeatedly.

QUESTIONS

1. *Intervention (treatment) package*—define it and give an example.
2. Discuss the use of intervention packages from the point of view of
   a. scientific, applied-behavior analysis research
   b. technology development
   c. providing a behavioral service
   d. the economics of intervening
3. For which of the following is an intervention (treatment) package usually *least* appropriate?
   a. scientific, applied-behavior analysis research
   b. technology development
   c. providing a behavioral service
4. If some components of an intervention were expensive and you would be using them repeatedly, then you should combine them as a treatment package rather than testing each component independently.
   a. true
   b. false

In the Skinner Box

EXPERIMENTAL ANALYSIS OF BEHAVIOR

Concurrent Contingencies and the Matching Law

Basic researchers often use concurrent schedules of reinforcement to study various preferences. They usually use two concurrent variable-interval schedules of reinforcement for physically incompatible responses (e.g., a 1-minute variable interval for the pigeon's pecking the left key and another 1-minute variable interval for the pigeon's pecking the right key).

Most often, researchers have used the same reinforcer (some particular mixture of "birdseed") for both schedules. With such concurrent schedules of variable-interval reinforcement, these researchers have studied a number of factors affecting preference for pecking, say, the left key over the right key. For example, they might adjust the variable-interval schedule so that the rate of reinforcement is more frequent on the left key. Or they might increase the amount of reinforcer, or the delay from the key peck to the actual delivery of the reinforcer. Sometimes they will even pair a small, immediate reinforcer in one schedule with a delayed, but larger, reinforcer in the other schedule.

But these researchers haven't always used the same reinforcers for both schedules; they've also used concurrent variable-interval schedules to study the preference for different types of reinforcers. For example, using pigeons, Dr. Harold Miller compared the quality of three different reinforcers—wheat, hemp, and buckwheat.[8]

Why are so many experimenters interested in this sort of research? Because this research seems to be helping behavior analysis become a precise, quantitative science, in which scientists can use mathematical equations to describe the behavior of nonhumans and humans.

Perhaps the most common equation used to describe these data is Dr. Richard Herrnstein's **matching law**.[9] One version of Herrnstein's matching law says that the relative frequency of responding on two concurrent schedules of reinforcement equals (matches) the relative frequency of reinforcers on those two schedules.[10]

$$\frac{\text{\# left-key pecks}}{\text{\# total key pecks}} = \frac{\text{\# left-key reinforcers}}{\text{\# total reinforcers}}$$

or % of left-key pecks = % of left key reinforcers.

Suppose, during a 1-hour experimental session, left-key pecks produced 60 reinforcers (VI 60″) and right-key pecks produced 30 reinforcers (VI 120″). Then the percentage of left-key reinforcers would be

60/(60 + 30) = 66%

and that means 66% of the total key pecks would be left-key pecks. (Note that we are not saying the frequency of responses equals the frequency of reinforcers; instead, we are saying ***relative*** frequency (percentage) of responses equals the ***relative*** frequency (percentage) of reinforcers.)

So if 66% of the value is obtained for pecking the left key, then the bird will make 66% of its pecks on that key. (When we talk about *value*, we mean such aspects of the reinforcer as its rate, amount, delay, and quality. And, yes, *value* does look suspiciously like a forbidden reification.)

Definition: PRINCIPLE

Matching law

- When two different responses
- are each reinforced with a different schedule of reinforcement,
- the relative frequency of the two responses
- equals the relative value of reinforcement
- on the two schedules of reinforcement.[11]

This matching law does two things: It allows scientists to describe precisely data produced by a single set of concurrent contingencies; and it allows them to predict behavior under novel sets of concurrent contingencies. For example, with his pigeons, Miller did this experiment: First, he ran one pair of concurrent schedules where *wheat* was the reinforcer for pecking one key and *buckwheat* was the reinforcer for the other. He ran his pigeons on these schedules until they produced stable rates of responding to both keys. Then he changed the procedure by running a different pair of concurrent schedules; here he kept *buckwheat* as one of the reinforcers but replaced wheat with *hemp* for the other. Again, he ran his pigeons on this new arrangement until their responding "preferences between the two keys" stabilized. Finally, he brought back the *wheat* reinforcer from the first contingency and kept the *hemp* reinforcer from the second contingency. And based on their preference for *wheat* vs. *buckwheat* and their preference for *hemp* vs. *buckwheat*, he could use the matching law to precisely predict their preference for *wheat* vs. *hemp*. Not a bad trick.

Here's another impressive trick: Herrnstein even figured out how to use his matching law to make precise, quantitative predictions of responding when he used only a single schedule.[12] In other words, the equation he originally developed for concurrent schedules turned out to work for single schedules as well! (But that's a complex story; check out the reference if you want more details.)*

QUESTION

1. State the matching law and describe a situation to which it can be applied.

Notes

1 Based on Koegel, R. L., Firestone, P. B., Kramme, K. W., & Dunlap, G. (1974). Increasing spontaneous play by suppressing self-stimulation in autistic children. *Journal of Applied Behavior Analysis*, *7*, 521–528. The graph is based on the same article.

2 Based on Goldiamond, I. (1984). Training parent trainers and ethicists in nonlinear analysis of behavior. In R. Dangel & R. Polster (Eds.), *Parent training foundations of research and practice*. New York: Guilford Press.

3 When two compatible or incompatible contingencies are concurrently available for the *same* response, they are called ***conjoint*** contingencies, not concurrent contingencies. But simply calling all contingencies that are available at the same time (i.e., concurrently) concurrent contingencies, and not dealing with the terminological distinction between conjoint and concurrent contingencies is enough for us. For a thoughtful, authoritative treatment of behavioral terminology, see Catania, A. C. (1998). *Learning* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

4 This section is based on an impressive, almost revolutionary, theoretical analysis of language learning by Drash, P. W., & Tudor, R. M. (1993). A functional analysis of verbal delay in preschool children: Implications for prevention and total recovery. *The Analysis of Verbal Behavior*, *11*, 19–29.

5 Based on Bauman, K. E., Reiss, M. L., Rogers, R. W., & Bailey, J. S. (1983). Dining out with children: Effectiveness

* In Chapter 3, we introduced the **law of effect**—the effects of our actions determine whether we will repeat them. The matching law is a special case of the law of effect where the effect of one contingency is influenced by concurrent competing contingencies.

of a parent advice package on pre-meal inappropriate behavior. *Journal of Applied Behavior Analysis*, *16*, 55–68. The associated graph is based on the same article.

6 Based on Clark, H. B., Greene, B. F., Macrae, J. W., McNees, M. P., Davis, J. L., & Risley, T. R. (1977). A parent advice package for family shopping trips: Development and evaluation. *Journal of Applied Behavior Analysis*, *10*, 605–624. The graph of data is based on the same article.

7 Based on Patterson, G. R. (1965). An application of conditioning techniques to the control of a hyperactive child. In L. P. Ullman & L. Krasner (Eds.), *Case studies in behavior modification* (pp. 370–375). New York: Holt, Rinehart & Winston.

8 Miller, H. L. (1976). Matching-based hedonic scaling in the pigeon. *Journal of the Experimental Analysis of Behavior*, *26*, 335–347.

9 Herrnstein, R. J. (1961). Relative and absolute strength of response as a function of frequency of reinforcement. *Journal of the Experimental Analysis of Behavior*, *4*, 267–272.

10 Baum, W. M., & Rachlin, H. C. (1969). Choice as time allocation. *Journal of the Experimental Analysis of Behavior*, *12*, 861–874.

11 For information about the theories and related research behind the matching law, see Mazur, J. E. (1998). *Learning and behavior* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

12 Herrnstein, R. J. (1970). On the law of effect. *Journal of the Experimental Analysis of Behavior*, *13*, 243–266. While you're in the library or online, you might also check out *Carrots and Sticks* by Ian Ayres, which is considered an example of behavioral economics, which, in turn, might be considered related to the sort of quantitative analyses that involve the matching law.

CHAPTER 23

Maintenance and Transfer

Behavior Analyst Certification Board 5th Edition Task List Items		
B-11.	Define and provide examples of discrimination, generalization, and maintenance.	Throughout
G-21.	Use procedures to promote stimulus and response generalization.	Pages 418–426
G-22.	Use procedures to promote maintenance.	Pages 413–415, 424

False Parable

THE LEGEND OF BIG BOB'S BOVINE

Once upon a time, two husky teenage members of the Future Farmers of America were arguing about who was stronger.

Big Bob said, "I'll bet 5 bucks I can lift your young heifer there."

Massive Mel replied, "You can lift Beulah? No, way, Jose. She weighs 1,000 pounds. You've got a bet."

Big Bob lifted, and grunted, and strained, and finally collapsed beside Beulah. After he'd forked out the 5 dollars, he said, "OK, I lost this time. But I'll make you a bet. I'll bet my pickup with the .22 rifle in the rear window against your Beulah. I'll bet that within less than a year I can lift a thousand-pound steer."

"You're on," Massive Mel replied.

As luck would have it, that very week a 50-pound calf was born on the farm of Big Bob's daddy. And every day, before going to school, Big Bob would lift that young calf. As the calf grew in weight, Bob grew in strength. But when the calf had reached 400 pounds, Big Bob was having to strain just to get it off the ground (he'd long since stopped above-the-head, one-hand grandstanding).

The calf kept growing; and so did Big Bob's strength. Now Massive Mel had been eyeing Big Bob's progress, and panic set in when he saw Big Bob lift the 900-pound steer. So he fell back on an unfair ploy. "Big Bob," he said, "my daddy says I got to sell Beulah at the 4-H fair tomorrow. So you either lift a 1,000-pound steer today, or all bets are off."

Big Bob hadn't yet gotten to the 1,000-pound mark, but the bank was ready to foreclose on his daddy's farm. If he could win Beulah, he himself could sell her at the 4-H fair, make the next payment on the farm, and keep the bankers away. Then he and his daddy could harvest their crops and completely pay off the loan.

With one hand, Big Bob slung a 100-pound feed sack over the back of the 900-pound steer (if quantitative analyses aren't your thing, let's just say that totals 1,000 pounds). Then, with a false air of confidence, he squatted down, put both of his massive arms beneath the steer's belly and gradually lifted. The steer's gut went higher and higher in the air, centimeter by centimeter. But Big Bob couldn't get his hoofs off the ground. After 2 minutes of straining, he finally collapsed.

Massive Mel smiled. "Where're the keys to my new truck?"

"Just a moment. You know I get three tries."

And try he did, but with even less success the second time.

After resting for 5 minutes, while Massive Mel sat in the pickup blowing the horn, Big Bob lumbered for one last time over to the side of the steer, which by this time was becoming a bit agitated. Everything depended on this last lift—the pickup, the .22, the farm, his chance to go to BSU on a 4-H scholarship, and his beloved Betty Sue, whose father would not let her keep the company of poor trash, which he would be if he didn't lift the 1,000-pound steer on this last lift and thereby avoid losing the farm.

He stood straight, flexed his arms, did three knee bends, put his arms beneath the steer's belly, and gradually lifted. The steer went higher and higher in the air, centimeter by centimeter. And it kept going, and going, until all four hoofs were 6 inches off the ground. Big Bob spun around in a 360-degree circle, with the steer in his arms, walked over to the pale Massive Mel, and sat the steer in front of him. Big Bob smiled and said, "Let's get in my pickup; I need to get my new heifer, Beulah."

Skeptical? You should be. This rural myth is made out of what Big Bob often stepped in as he trudged across the cattle pen to pick up the calf. The myth is that, if you just add a little bit every day, there's no limit to what you can accomplish. The truth is that if you just add a little bit every day, you can accomplish a lot; but there is a limit. Now let's look at a similar psychological myth.

Controversy

THE MYTH OF PERPETUAL BEHAVIOR AND THE MYTH OF INTERMITTENT REINFORCEMENT

You've heard of the quest for the perpetual-motion machine? You wind it up, start it going, and it generates its own energy and never runs out of fuel. No more inputs required—no more gas, no more electricity, no more turning the crank. (And while the perpetual-motion machine's doing all our work, we can retire to Florida and fritter away our time in the quest for the fountain of perpetual youth.) Everyone wants the perpetual-motion machine, but no perpetual-motion machine exists.

Behaviorists often get sucked into their own similar futile quest. Behaviorists search for the ***perpetual-behavior intervention***: *You modify the behavior, the modified behavior maintains itself, and you never have to deliver another behavioral consequence*. That's the myth of perpetual behavior. Once you intervene, the improved behavior runs on forever, with no more inputs required—no more contingency management, no more contingency contracts. Everyone wants the perpetual-behavior intervention. No perpetual-behavior intervention exists—at least not when you need it most.

Everyone wants a quick fix. The preacher wants to preach an hour on Sunday and have the parishioners lead lives of virtue the rest of the week. The psychoanalyst wants to psychoanalyze an hour on Monday and have the patients lead lives of mental health the rest of the week. The teacher wants to lecture an hour on Wednesday and have the students lead lives of intellectual inquiry forever.

Everyone's naïve. There ain't no easy fix.

There ain't no easy solution.

Behaviorists often get too desperate in their quest for the perpetual-behavior intervention. They try to attain that perpetual maintenance with schedules of intermittent reinforcement—for example, variable-interval and variable-ratio schedules. Why?

Well, first, recall the concept of resistance to extinction—the number of responses or the time before a response extinguishes. And recall the principle of resistance to extinction—intermittent reinforcement makes the response more resistant to extinction than does continuous reinforcement. The illogical reasoning in the quest for the perpetual-behavior intervention goes like this: We use continuous reinforcement to establish some desirable behavior, and then we change the schedule of reinforcement to one with fewer and fewer reinforcers. So the person builds greater and greater resistance to extinction. In time, reinforcement becomes so rare and the resistance to extinction so high that we can stop reinforcement altogether. Then the person will keep on responding forever and ever, without limit. This is what we call ***the myth of intermittent reinforcement***: *You can gradually reduce the frequency of reinforcement until the behavior maintains without reinforcement*. It's like Big Bob's gradually increasing the weight he was lifting, and gradually increasing his strength, until he could lift almost any weight, without limit. But the truth is this: There's a limit. So what about the popular notion of unlimited resistance to extinction based on a history of less and less reinforcement? It's made of the same organic barnyard matter as the legend of Big Bob. There's a limit.

Moral: Our bodies are subject to the laws of physics, including the law of gravity. And our behavior is subject to the laws of behavior, including the law of effect. Just as the law of gravity says our bodies will fall if not supported, the law of effect says our behavior will stop if not reinforced. (As a reminder, the law of effect says the effects of our actions determine whether we will repeat them.)

Although there is no perpetual-behavior intervention, we can almost constantly maintain good performance and suppress undesirable performance in two ways. The first part of this chapter is about how we try to do that. But it's not about trying to become independent of the law of effect.

Definition: CONCEPT

Performance maintenance

- The continuing of performance
- after it was first established.

There's still some confusion, so let me repeat the main point: **There is no such thing as unlimited resistance to extinction**; so you can't use it to maintain performance indefinitely.

QUESTIONS

1. What is the myth of perpetual behavior?
2. What is the myth of intermittent reinforcement?
3. How does the law of effect relate to these myths?
4. *Performance maintenance*—define it.

Example

Behavioral School Psychology

JUNGLE JIM, THE SOCIAL CLIMBER[1]

Jim spent most of his time at preschool wandering about, bored, sampling first one activity then another, almost always avoiding physical games, not impressed and not entertained. Once in a while he'd try to play with the other kids, but in his clumsy way he'd always mess it up, and the teachers would have to come to his rescue.

The teachers wanted Jim to take part in physical activities so he'd have a chance to play constructively with the other kids; they hoped he might learn better social skills through such play. But before they started to intervene with their planned reinforcement procedure, they measured his performance during baseline. They found that 25% of the time, Jim just hung out, simply standing by himself or walking around, and 75% of the time, he did quiet things by himself, like playing in the sandbox.

Then it was time to start their reinforcement procedure. Whenever Jim walked by the monkey bars, the teachers would talk to him, smile, pat him on the shoulder, and bring him things to play with. At other times, they ignored him, busying themselves with other activities. Because of this reinforcement procedure, Jim gradually came to spend more time closer and closer to the monkey bars—somehow life was better in that neighborhood, though Jim probably had not realized life held more reinforcers near the monkey bars or even that he was now hanging out in this new spot. (Therefore, the direct-acting contingency of the social reinforcement probably controlled Jim's behavior; it was probably not rule governed.)

After a while, Jim began touching the monkey bars and even climbing them briefly. From then on, the teachers reinforced only his climbing; just being in the right neighborhood no longer did the trick. In this way, the teachers used the method of successive approximation to shape Jim's climbing the bars, so that after 9 days of reinforcement, he was climbing the bars 67% of the time. In the process he also became much less of a climbing klutz, perhaps not a young Tarzan, but not bad. (The teachers also started sending a few social reinforcers Jim's way when he played with any of the other active toys, like the ladders, packing boxes, and other frames.)

However, the playground teachers couldn't spend all their time and energy reinforcing Jim's athletic acts, so they slowly increased the number of times Jim climbed on the monkey bars before delivering their reinforcing attention. (In that way, they went from continuous reinforcement to the more cost-effective intermittent schedule, probably ratio reinforcement, though a variable-interval schedule might have worked just as well.)

Also, as the days passed, they reduced the size of the reinforcer. Near the end, Jim's athletics got only a brief nod. And at the close of their intervention, Jim got no more attention than did the other kids in the preschool; yet he was spending a third of his time in vigorous activity (before they intervened, he spent less than 1/10th of his time in such activity). And when he came back to the preschool the next fall, Jim spent more than half his outdoor play in vigorous activities, just like any other normal kid (Figure 23.1).

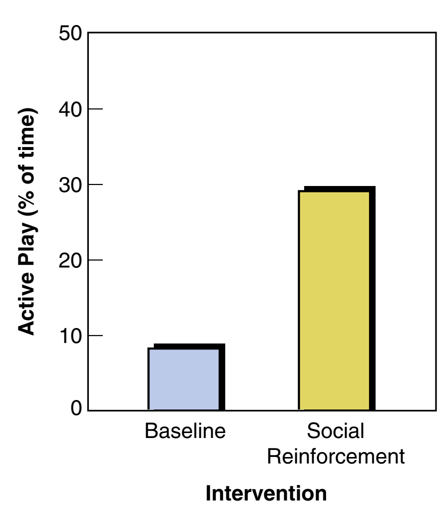


Figure 23.1 Using Social Reinforcement to Shape the Active Play of an Apathetic Child

QUESTION

1. Describe a behavioral intervention to increase the active play social interactions of a withdrawn preschool child.
   - What's the behavior?
   - The various reinforcers?
   - The schedule of reinforcement at first and then later?

Concept

SETTING A BEHAVIOR TRAP TO MAINTAIN PERFORMANCE[2] (G-22)

At first glance it might look as if the teachers were going for the elusive perpetual-behavior intervention based on the myth of intermittent reinforcement. But probably not. As they gradually decreased the frequency and duration of their added social reinforcement, the natural reinforcement contingencies of the monkey bars were themselves coming to control Jim's playing. So, in the end, Jim didn't need the added reinforcement contingencies; the natural reinforcement contingencies were enough. This is an example of a **behavior trap**.

Definition: PRINCIPLE

Behavior trap

- Use an added reinforcement contingency
- to increase the rate of behavior.
- Then the behavior can be reinforced by
- natural reinforcement contingencies,
- and those natural contingencies
- can maintain that behavior.

Let's look further at a behavior trap. Suppose Jim never played on the monkey bars. Then, of course, the reinforcers naturally built into such play could not help him acquire an adequate play repertoire. Or suppose he had sometimes played, but with little skill. Then his behavior still might not have contacted those natural reinforcement contingencies, or at least not often enough to help him acquire that skilled repertoire. Here's what the teachers' social reinforcers did. They caused Jim to monkey around the bars frequently enough for two things to happen: (1) He acquired good climbing skills, and (2) the natural delights of the activity frequently reinforced and thus finally "trapped" his climbing. So a behavior intervention leads a behavior into a behavior trap. A **behavior trap** is a procedure using a shifting set of reinforcement contingencies (shifting from artificial to natural) that get ahold of behavior and won't let go.

Originally, *behavior (behavioral) trap** referred to the unprogrammed social reinforcers that maintained behavior, once someone had learned that behavior. But the concept has more generality than that. For example, the intrinsic, natural reinforcement contingencies in reading maintain that behavior, once a person has learned to read.

Also, it should be possible to build a behavior trap based on reinforcement by the removal of an aversive stimulus.

Behavior traps are great things, but they ain't always there when you need 'em. So once you get the behavior occurring at a high rate, don't just walk away assuming a behavior trap will come along to maintain it. Often when it seems natural that there should be one, it won't show up.

QUESTION

1. *Behavior trap*—define it and give an example.

Example

Behavioral Medicine

BEHAVIOR TRAPS, EXTENDED PROGRAMS, AND DICKY AT 13[3]

Remember Dicky, the 3-year-old boy with autism from Chapter 18? Wolf, Risley, and Mees saved Dicky's eyesight, using ice cream to differentially reinforce Dicky's putting on his glasses. Happily, Dicky didn't need the added ice cream reinforcer forever. We assume this is because the natural reinforcement contingency of seeing so much better came to maintain putting on the glasses. In other words, Dicky fell into a behavior trap. The automatic reinforcers of seeing better maintained Dicky's performance: Those reinforcers trapped Dicky's putting on his glasses and saved his eyes.

Remember Dicky, the 7-year-old boy with autism from Chapter 16? Risley and Wolf and then Dicky's parents helped Dicky learn to talk normally, using imitation, verbal prompts, and discrimination training. Again, Dicky fell into a behavior

* We prefer *behavior trap* to the older terminology *behavioral trap* because it emphasizes that it is behavior that's being trapped. (Of course, you could say *behavioral behavior trap*, but please don't!)

trap as the natural reinforcers for speaking came to maintain his performance—his continuing to speak normally.

Because of continued work with Dicky, his overall IQ had risen from being unmeasurable at age 3 to 81 at age 13, and his verbal IQ was 106. Not only that, he had progressed so much that he could start attending regular classes in the public school. Dicky still had some autistic behaviors, like rocking and hand clapping, but he had come a long way. For example, he could carry on long conversations using an advanced vocabulary for his age. With proper behavioral programs, behavior traps, and other support systems, major repertoire changes can be made and maintained.

The last we heard of Dicky he was in his 30s, living in a supervised apartment and doing supervised janitorial work in the state of Washington. Dicky has copies of some of the articles describing the research he participated in.

QUESTION

1. How did behavior traps help Dicky, the boy with autism, continue to wear his glasses and maintain his talking?

Example

Behavioral Medicine

RECLAIMING A SMALL GIRL FROM AN INSTITUTION FOR THE DEVELOPMENTALLY DISABLED[4]

Sally was a young resident of a center for the developmentally disabled. She could barely walk and could not perform even simple movements with her hands. She couldn't speak a sentence or name objects, but she was able to mimic other people's words. She was so lacking in skills that she couldn't be tested using the so-called intelligence tests.

Because Sally had weak leg muscles and poor coordination, she found no natural reinforcement contingencies when she tried to ride a bicycle or engage in other physical activities. So Dr. Todd Risley used candy to reinforce her physical activities. He mounted a bicycle on a stationary frame so that the wheels turned when she pushed the pedals. In the first stage, Todd reinforced her sitting on the bike. In a later stage, an automatic candy dispenser delivered a small piece of candy each time she turned the wheels of the bicycle around for five revolutions (fixed ratio 5). After she had perfected this, the requirement gradually increased until she had to turn the wheels around many times before getting a piece of candy. At the same time, and by small degrees, Todd adjusted the pressure on the back wheel so that it took much more effort to turn the pedals.

After some months of this training, Sally's muscles developed to the point where she spent hours pedaling her bicycle and eating her candy reinforcers. When she gained enough coordination and strength, Todd took the bicycle down from its stationary position and, through the use of reinforcement, Sally learned to ride it in the driveway. Once Sally could ride her bike freely, she no longer needed the added candy reinforcers; then she rode for hours just as other children do. Her behavior was trapped by the natural reinforcement contingencies involving riding.

During this same time, Todd began a lengthy and intensive behavioral program to improve Sally's language skills, her responding to different stimuli, and her naming objects. He also trained her to play games and work puzzles. As an example of these interventions, Todd uttered a word and if Sally repeated it, he quickly gave her a small piece of candy and perhaps a pat on the head while he said, "Good." After months of this procedure, she was able to name objects and finally talk using short sentences.

Following this training, Sally progressed to the point where Todd tested her skills with a standard intelligence test. Her intelligence quotient increased enough to allow her to leave the institution and enter a special class in the public school system. Probably Sally would still be in that institution if Todd Risley hadn't intervened with these intensive behavioral procedures.

Analysis

Sally's bicycle riding shows performance maintained by the behavior trap. She had neither the behavioral skills nor the physical strength to contact the natural reinforcement contingencies supporting biking. She needed the help of added reinforcement contingencies from Risley's behavioral intervention. But once she had acquired the strength and skills, the natural positive reinforcers of biking were an effective trap to maintain that behavior.

QUESTIONS

1. Describe a procedure to help a child with developmental disabilities acquire the needed strength and skills for bike riding.
2. What role did the behavior trap play?

USE INTERMITTENT CONTINGENCIES TO MAINTAIN PERFORMANCE

In Chapter 17, we discussed the program Linda Pfiffner and Susan O'Leary used to help grade-school students get on task in a remedial classroom. They used concurrent reinforcement with all sorts of goodies and avoidance of reprimands to move the students from being on task 41% of the time to 80%.

Now the question was, could they reduce the frequency of reprimands and yet keep the students on task? When they stopped the reprimands abruptly, time on task fell to 47%. But when they slowly reduced the reprimands to a low level, over a 6-day period, the students stayed on task 87% of the time. This suggests that avoidance of an aversive condition that's only intermittent may do the trick, once you already have a high rate of avoidance responses.

QUESTIONS

1. Describe a procedure used to maintain the performance of grade-school students in a remedial classroom.
2. What point does this illustrate?

MAINTAIN THE CONTINGENCIES AND YOU'LL MAINTAIN PERFORMANCE

Remember Peter, the boy with the developmental disability who choked, kicked, hit, pulled, and pushed people an average of 63 times each 6-hour school day (Chapter 8)? Within a couple of days of using contingent exercise as a punishment procedure, Stephen Luce and his colleagues got big results. They had reduced that violent physical aggression to an average of two times a day.

Great, but how can we keep Peter cooled out? Simple: Just keep the exercise contingency in place. That's what they did, and it worked. Twenty-six days later, Peter's physical aggression had dropped to one attack a day.

Perpetual-Contingency Contracting

In Chapter 3 and other earlier chapters, we mentioned the concept of **contingency contract**—*a written rule statement describing the desired or undesired behavior, the occasion when the behavior should or should not occur, and the added outcome for that behavior*. Contingency contracting is the most useful tool I have for keeping my act together. I've been using contingency contracts for over 40 years to break that old procrastinatin' rhythm. Without it, we wouldn't have gotten the 1st edition of this book written, let alone the present edition. I do contingency contracting for my work, my diet, my exercise—you name it. I've used all sorts of methods: face-to-face, weekly, or even daily meetings with a performance manager, a daily telephone meeting with a manager I never saw (she was called "Conscience" and worked in Dr. Joseph Parson's Conscience International at the University of Victoria). And I'm still using performance management to make sure I do my review of the publisher's editing of these very chapters before the looming deadline.

Here's my point: Often there's no behavior trap to grab your performance in its gentle grip and keep you going in the right direction. That sure seems true with dieting, exercising, and writing. We enjoy having done them, and we may even enjoy doing them. But that's not enough. The unprogrammed contingencies are small and of only cumulative value. So most of us need some sort of contracting to achieve optimum performance. Most of us need rules that are easy to follow, even if they describe contingencies that are not direct acting. We need rules that describe sizable, probable outcomes, even if they are delayed.

Don't feel as if you're a loser if you can't pull off the big ones without help. Even professional writers constantly fight the devil and her temptations. The winners use all sorts of goal-setting, word-counting, and charting techniques to manage their performance.[5] Imagine what they could do with Conscience International.

Maintain the contingencies and you'll maintain the performance.

By perpetual-contingency contracting, we mean that you'll often get the most out of contingency contracting if you use it to maintain desirable performance all your life. You don't think of it as a phase you go through. For example, suppose you want to lose weight and then keep it off. You shouldn't go on a diet until you've hit your goal weight and then go back to pig-out city. You need to be on a diet the rest of your life. And we find perpetual-contingency contracting is our best way to keep a lifelong diet. The same applies to exercise, writing—all of life's evasive goals.

QUESTIONS

1. Give an example of maintaining a punishment contingency to maintain the suppression of undesirable behavior.
2. What do you do when there's no behavior trap to maintain performance? Give an example.

THE MAIN POINT

What's the main point of this chapter? The main point is that the only way you can maintain an increased rate of performance is to maintain some sort of supporting contingencies. It doesn't matter whether those supporting contingencies are built-in natural contingencies the client now contacts or whether they are added performance-management contingencies a performance manager must always provide. Avoid the traditional error of assuming that once you've really modified behavior, the behavior will maintain itself. Not true. **Behavior will not be maintained without supporting contingencies.**

QUESTION

1. What's the main point of this chapter?

WHAT TO DO AFTER THE PERFORMANCE MANAGER GOES HOME OR AFTER THE DOCTORAL STUDENT FINISHES THEIR DISSERTATION

It's hard to develop performance management systems that maintain for the years clients often need them. Part of the problem is that behavior analysts are controlled by direct- and indirect-acting contingencies, just like everyone else. Many of the articles published in journals are grad students' dissertations. But by the time the students demonstrate that their interventions work, they're tired of living on peanut-butter-and-jelly sandwiches and want to earn a decent living. So they can't afford to stick around long enough to demonstrate performance maintenance.

However, the problem of developing a maintainable technology is so crucial that some behavioral journals now have the policy of publishing only articles that have at least a 6-month follow-up. This should move our field in the right direction.

One solution might be for the students to train the direct care staff in how to maintain the interventions. Unfortunately, this only works if the contingencies support the direct care staff's behavior of maintaining the intervention. But, the contingencies in the "real world" rarely support maintenance.

Concept

TRANSFER OF TRAINING

"The problem with applied behavior analysis is that the behavior change won't transfer outside the behavior analyst's lab."

"What do you mean, it won't transfer?"

"Well, suppose you work with someone who has a behavior problem in your lab. Let's say your client no longer talks. Suppose you use reinforcement procedures and gradually reestablish talking. Now you have reinforced talking in the lab. But will it transfer out onto the ward? And, even if it does transfer, will it continue to occur, or will the conditions in the ward get rid of talking again?"

I realized she was baiting me; she knew I was a strong advocate of the use of reinforcement principles in applied behavior analysis. On the other hand, I knew she wasn't merely teasing me; she had criticized the use of the principles of behavior in her psychology lectures. I should convince her that the principles of behavior would work. Then she might be less likely to say this in her class and mislead her students. Besides, I was a junior member of the psychology department, and this was my first job; I wanted to please and impress her, so I replied, "What you say is complete and utter nonsense and indicates your lack of understanding of the principles of behavior."

I could see by the expression on her face that she was impressed. I continued, "We must be concerned with two things in transferring behavior change: First, we must make sure the **situation of the intervention is similar to the client's normal environment**; then behavior change will transfer to the normal environment. A good way to deal with this problem is actually to intervene in the patient's normal environment rather than in the lab.

"Second, we must make sure the client's **normal environment maintains the behavior change** we bring about. For example, the client may want to get rid of some undesirable behavior. And we might eliminate such behavior, but then we want to be sure the client's normal environment doesn't reinforce that behavior again. Here is one way to do it: Attention might have reinforced the inappropriate behavior. We could reinforce some other response—one more effective in getting attention but one that also is more socially desirable. Then the client's normal environment might never get the chance to reinforce the undesirable response again.

"A problem in the maintenance of behavior change occurs when we want to reinforce some missing behavior. Then we must be sure reinforcement procedures operate in the client's normal environment so the behavior won't extinguish.

"One solution is to **reinforce desirable behavior that will be successful in obtaining reinforcers in the client's normal environment**. The client's environment might be effective enough to maintain the behaviors once we reinforce those behaviors, but might not be effective enough to reinforce them in the first place. Because of an inappropriate environment, a child might not have learned to talk. But if we shape an adequate repertoire of verbal responses in the lab, then natural reinforcers that maintain most of our verbal behavior might maintain the child's verbal behavior. We call those natural reinforcers a behavior trap."

I paused for dramatic effect and then looked my antagonist straight in the eye. "So you see, we can transfer and maintain behavior change to the client's everyday environment."

I expected her to jump from her seat, run around her desk, pound me heartily on the back, and exclaim, "I apologize, my good man, for not having sooner recognized that you speak the truth." To that I would reply, "Ah, don't apologize. I realize that we new faculty members must prove ourselves." In so doing, I would display my good breeding, humility, and generosity.

But instead she stared at the desk and merely said, "Hah."

"Well, does what I say make any sense to you?" I asked.

"Yes," she mumbled, and began shuffling through some papers on her desk.

I walked out feeling I had done humankind a good deed. Now she would no longer tell her students that applied behavior analysis was no good because it wouldn't transfer to other stimulus situations.

Several days later I had an experience—the first of several similar experiences—that gave me a valuable lesson. I overheard some of her students discussing a lecture she had just given. They were saying how impressed they were as she argued that applied behavior analysis wasn't of much value because its effects wouldn't transfer. At least it was clear that the effects of my attempts at modifying her behavior had not transferred from her office to her classroom. Later I came to realize that a person's refusal to violently disagree with me simply may mean that person no longer wishes to argue.

This dialogue is not as far-fetched and ivory towered as it might seem, and it's not altogether hypothetical. Similar dialogues occur every day at clinics, institutions, and public schools. The disagreement revolves around this situation: A behavior analyst, whether a psychologist, nursery school teacher, or other professional, uses behavioral techniques (extinction, reinforcement, stimulus discrimination) to bring about changes in the behavior of clients, students, or subjects. And the behavior analyst is successful in changing behavior for the well-being of the patient.

The critic admits the initial success in changing behavior. But the critic says that such change is shallow. The behavior analyst has not cured the client's problem. Although the behavior has changed, it won't endure over time or won't maintain in the client's everyday environment. For the critic, the word *cure* is important. The critic views behavior problems as diseases; and, of course, what can you do with a disease but cure it? If it were a real cure, the disease wouldn't come creeping back (another problem with the medical-model myth).

Those who have used reinforcement principles in changing behavior agree with the critic. And they may reply that the behavior change may not hold up over time and in different environments. But that doesn't mean the original behavior problem was a disease, or that the behavioral intervention was a cure. They modified behavior under a certain set of conditions. The job only begins with changing the behavior. The job ends with maintaining the behavior for longer periods in other settings.

Most behavior analysts know the problems involved in transferring behavior change. Generally, they know what to do. They may agree that to increase the probability of maintaining the behavior outside the training setting, they need to expose the client to many of the similar stresses, strains, and stimulus conditions he or she would find outside. If they slowly and gradually introduce aspects of the external environment, the client's behavior would transfer from the training setting to the community more easily. But sometimes these procedures are unrealistic and costly and require too much time. Then behavior analysts must either find a new technique or admit that they don't have the time, money, or control to pull it off. But transfer of training based on applied behavior analysis remains a technical problem, not a fundamental theoretical one.

Definition: CONCEPT

Transfer of training

- Performance established
- at one time
- in one place
- now occurs in a different time and place.

QUESTIONS

1. *Transfer of training*—define it and give an example.
2. What do critics of applied behavior analysis say about the transfer of training and the maintenance of performance?
3. And what might a behavior analyst reply?

REDUCE STIMULUS CONTROL AND INCREASE TRANSFER (G-21)

We discussed Velma and Gerri in Chapters 2 and 8. These women with profound mental impairment ruined most of their teeth by constantly grinding them (bruxism). Ronald Blount and his colleagues used a mild punishment contingency based on brief contact with an ice cube to reduce their teeth grinding from 62% to 3% of the time.

They also tested for transfer of the effects of this contingency to times during the day when it was not in effect. They found a frequency of 27% during these tests of transfer. Not as good as the 3% when the contingency was in effect, but much better than the 62% during baseline, and it was free—no one was managing their performance then.

The considerable transfer they got might be due to poor stimulus control. The stimulus conditions differed little between the punishment-based discriminative stimulus and the punishment-based S^{Δ}. For Velma in particular, who was blind and deaf, the main difference was whether she had recently ground her teeth and then felt the ice cube on her face.

The authors said they might have further decreased that stimulus control if they had had frequent brief periods of training spread throughout the day, rather than the two longer sessions per day.

Let's run this down one more time, because some students find it confusing; let's also toss in a little refresher course along the way. Please answer the following multiple-choice questions as a review:

1. *Stimulus discrimination* and *stimulus control* are the same thing.

   a. true
   b. false

2. Responding at the same frequency in the presence of the S^{Δ} as in the presence of the S^D shows

   a. little stimulus discrimination.
   b. much stimulus discrimination.

3. Responding at the same frequency in the presence of the S^{Δ} as in the presence of the S^D shows

   a. little stimulus control.
   b. much stimulus control.

4. Responding at the same frequency in the presence of the S^{Δ} as in the presence of the S^D shows

   a. little stimulus generalization.
   b. much stimulus generalization.

5. Stimulus control (stimulus discrimination) is the opposite of stimulus generalization.

   a. true
   b. false

6. Suppose Velma and Gerri grind their teeth at almost the same low frequency when the punishment contingency is *not* in effect as when it is in effect. This is an example of

   a. much stimulus generalization.
   b. little stimulus generalization.

7. Suppose Velma and Gerri grind their teeth at almost the same low frequency when the punishment contingency is *not* in effect as when it is in effect. This is an example of

   a. good stimulus control (good stimulus discrimination).
   b. poor stimulus control (poor stimulus discrimination).

QUESTIONS

1. Explain the relation between stimulus control and transfer of training to reduce teeth grinding. Warning: Quite a few students blow this one on the quiz. Please be sure you've got it.
2. While you're at it, it wouldn't hurt to be sure you can correctly answer those little multiple-choice review questions, just in case one pops up on your quiz.

Example

Developmental Disabilities

STREETWISE[6]

Problem

Fact 1: Crossing the street is hazardous to your health. *In 2015, 5,376 pedestrians were killed in traffic crashes in the United States. This averages to one crash-related pedestrian death every 1.6 hours.*[7] Fact 2: To help developmentally delayed people live better lives, human services agencies are moving them from institutions (*deinstitutionalization*) to more normal environments (*normalization*). And the normal environment is dangerous enough for "normal" people, let alone those with behavior problems.

Solution

For his master's thesis at Western Michigan University, Terry Page, along with Brian Iwata and Nancy Neef, did something to help. Working with five young men with developmental delays, these behavior analysts developed a program to teach independent street crossing, without taking their students onto the streets.

The students worked with a poster-board model of four city blocks. The model had streets, houses, trees, people, cars, stop signs, a traffic light, and a "walk–don't walk" pedestrian light.

Terry and his colleagues did a *task analysis* of the *behavioral chains* involved in safely crossing the street. For example, crossing at a pedestrian light involved stopping at the intersection, crossing with a latency of less than 5 seconds after the *walk* signal, looking both left and right while in the street, and never stopping until reaching the other side.

Training consisted of the student's moving a small pedestrian doll from one location to another on the model. When the student did all components of the chain right, he received praise. When he made an error, he received imitation training, with a demonstration by the trainer, along with another chance to do it right.

But now comes what we think is the most innovative and most crucial part of this program. The students had to say what the doll was doing. In essence, the students had to state the rule of safe street crossing for each component of the task.

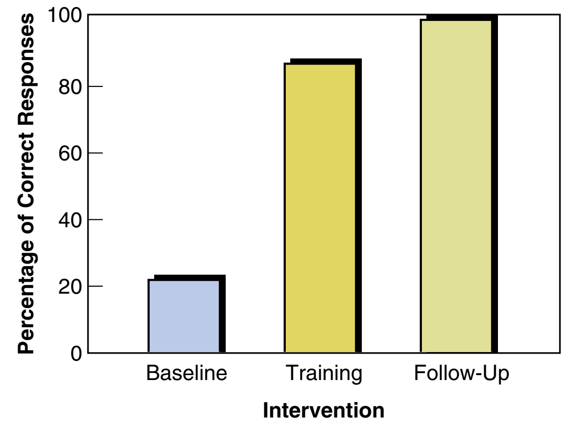


Figure 23.2 Safe Street Crossing Transfer of Training with a Model

Results

The students learned to move the doll safely in the classroom. But more to the point, they also learned to move themselves safely on the mean streets. They went from 4.3 of 17 possible correct responses during baseline to 15 out of 17 at the end of training and to 17 out of 17 during a follow-up (as long as 35 days after training had stopped; Figure 23.2). How well do you think you would score?

QUESTION

1. Describe a procedure to help people with developmental delays acquire a repertoire of safe street crossing. What was the
   a. task analysis?
   b. training setting?
   c. training procedure?
   d. training responses?
   e. reinforcer?
   f. testing setting?
   g. testing responses?

Warning: You may need to have the details wired to do well on a quiz over this chapter.

STIMULUS GENERALIZATION AND RESPONSE INDUCTION IS NOT ENOUGH

Now, what's going on here? Responsible behavior analysts worry a lot about getting training to transfer to novel settings. But Terry and crew got almost perfect transfer with almost no effort.

But that view should make us itch. *Stimulus generalization* more or less means *confusion*. It means *poor stimulus control*. It means *failure to discriminate*. And even though these people had IQ scores only around 60, they could tell the difference between a poster-board model sitting on the table in a classroom and four real city blocks with real cars, trees, and so on. And they certainly could tell the difference between moving a small model pedestrian and their own walking across a street. They sure as heck could tell the difference between themselves and the small pedestrian doll they were shoving around the table.

In fact, the physical similarities between the model and the real thing are so small, you'd probably get no stimulus generalization between the two, not even with a pigeon, let alone with a human being.

And remember *response induction*—reinforcing or punishing one response along a dimension (such as distance of the lever press) also increases or decreases the frequency of other responses along that dimension, even though those other responses won't produce the reinforcer or punisher (Chapter 11). Does response induction explain Terry's results? Do you think moving the doll around with your hand is in the same response as moving yourself around with your two feet? Do you think they're enough alike on any response dimension, such as topography? Do you think they serve the same function (produce the same outcome)? In other words, is getting a doll on the other side of a play street the same thing as getting yourself on the other side of a real street? You should have answered with a long string of *no*s.

And suppose you're training your average chimpanzee. Suppose you managed to get it to move the doll properly around the model streets. Do you think the doll movements would in any way share the effects of the reinforcement with the chimp's crossing the real streets? Do you think increasing doll safety would increase chimp safety? *No, no*.

We hope you did answer all those questions with a *no way*—no stimulus generalization and no response induction. Not only could a pigeon or a chimp see the difference between the model and reality, we also think they couldn't see the similarity. But, it seems so natural, so intuitively obvious, to us that our moving a doll on a model street is similar to our moving ourselves on a real street. So when we start working with nonverbal children with autistic repertoires, we're shocked when the child can say "Mommy" to pictures of Mommy, but not to Mommy herself, at least not without a lot of training.

QUESTIONS

1. *Stimulus discrimination* and *stimulus control* are the same thing.
   a. true
   b. false
2. Responding at the same frequency in the presence of the S^{Δ} as in the presence of the S^D shows
   a. little stimulus control
   b. much stimulus control
3. Responding at the same frequency in the presence of the S^{Δ} as in the presence of the S^D shows
   a. little stimulus generalization
   b. much stimulus generalization
4. Stimulus control (stimulus discrimination) is the opposite of stimulus generalization.
   a. true
   b. false
5. The trainees could readily discriminate between all aspects of the training setting with the models and the real world on the streets.
   a. true
   b. false
6. The trainees showed much *stimulus* generalization between all aspects of the training setting with the models and the real world on the streets.
   a. true
   b. false
7. The trainees showed much *response induction* between all aspects of the training setting with the models and the real world on the streets.
   a. true
   b. false

COULD RULE-GOVERNED BEHAVIOR SUPPORT TRANSFER OF TRAINING?

The students with developmental delays did show terrific transfer, but surely stimulus generalization and response induction can't be the cause. Then what could be? As we hinted earlier, we think this terrific transfer of training is an example of rule-governed behavior. The students learned to say the rules while being trained with the model person, car, crossing, and so on. And the students' statements of the rules governed the behavior of their moving the model person. For example, we suspect the model of the street crossing was an S^D for the students to say, "Stop at the crossing." or simply, "Stop."

At this point, we must rely on a complex behavioral history of these young men, though they were classified as developmentally delayed. For example, we think the model and the real crossing were part of the same "stimulus class": not because of physical similarity but because of an elaborate, language-based behavioral history. In essence, someone had told them the model crossing "stood for" the real crossing.* So when they came to the real crossing, it may have caused the verbal response, "Stop," at the crossing (though not through any simple process of stimulus generalization). And in turn, that implied rule may have caused them to stop.

Of course, our analysis is untested. But we think the traditional analysis, in terms of generalization, is too misleading. And we had to offer you at least something to chew on until the real thing comes along. And even if we are crossing the right street at the right crossing, we need research on what behavioral history causes this rule-governed transfer of training and why verbal behavior seems so crucial.

QUESTION

1. Describe the role of rule control in the training and transfer of safe street crossing.

Example

RULE-GOVERNED BEHAVIOR IN THE CLASSROOM[8]

A cloud had hung over Mae Robinson ever since she'd gotten the letter from the board of education. They would close down the Rosa Parks Academy at the end of the year. They valued her work but just didn't have the money. Sure, they value my work, Mae thought sarcastically. She sat with her head in her hands. No one really cares about these kids or the work we've done.

When she heard footsteps approaching her office, Mae dropped the role of the unappreciated and assumed her role of principal and founder of the Rosa Parks Academy.

* We put quotes around *stimulus class* because this is probably some sort of rule-governed *analog* to a stimulus class. But we don't know of any research pointing to the behavioral processes underlying the creation of such analog stimulus classes.

Once again, Jack Lewis strode into Mae's office. It had been 6 months since his first visit. Jimmy Lewis had made great progress. Sometimes he had a tantrum, but he'd stopped his most aggressive and destructive behaviors. He could speak a few phrases, knew the words for many common objects and reinforcers, and could dress himself and use the toilet.

"Dr. Robinson, you've done wonders with my son. Amy and I can't thank you enough."

"That's nice of you to say, Jack. But you and Amy and Jimmy did most of the work. A child like Jimmy can't make so much progress unless his parents dedicate much of their lives to helping him. You and Amy have done that. The work we do at the school with a child with autism won't transfer to the home unless the parents keep the program going."

"It's funny, Dr. Robinson, but of all Jimmy's progress, you know what we value most? He is becoming a loving and affectionate son. Before, he treated us like pieces of furniture. Now he treats us like people he loves and cares for. I can hardly wait to see what you'll have done for him by this time next year."

"I'm sorry, Jack. In spite of all your help and your arguing with the school board, there won't be a next year—at least not for the Rosa Parks Academy. We'll be a parking lot."

"Damn! I thought we'd won that battle. What we need are more data about how good your school is."

"Unfortunately, Jack, data don't always convince school boards."

"Well, I know someone who built her life on data—one of my friends from the club. She's a computer engineer, and she's made a fortune using data-based techniques to evaluate and improve her product line. She also donates some of that fortune to human service and education programs that convince her they're worthwhile. But few have convinced her. She says most human service and education programs are just hot air—a waste of money.

"She knows Jimmy, and his progress impresses her. She also knows you need support. But she remains a scientific skeptic; she's waiting for you to prove that Jimmy can make academic progress. Not only that, she thinks Jimmy needs to be able to work in a more typical special ed classroom, one with one teacher and several children, not just the one-on-one training you've been using. She says she wants a more cost-effective procedure.

"You've got only a few weeks until the bulldozers roll in, but if you can pull it off, I think she'll save your school."

Though she didn't think it would work, Mae put Jimmy in the special ed classroom where Max was doing his behavior-analysis practicum. Disaster city: Jimmy only did 1% of his worksheet problems correctly. Mae and her staff were already working full-time with Jimmy. Now they had to work overtime.

Training Jimmy to Self-Instruct

Remember matching-to-sample—selecting a comparison stimulus equal to a sample stimulus (Chapter 15)? Jimmy had no problem matching, so now it was time for him to do something more like traditional academic work, something that would impress even the skeptical computer engineer. This time, Mae selected matching-to-sample in which the stimuli were common sequences of written letters. Here's an example:

Stimulus-Matching Task

Sample Stimulus	Comparison Stimuli
ock	Mick dock luck clock sick

In each class, Jimmy had a series of problems like that. He was to circle the comparison stimuli whose last letters matched the sample stimulus. But now Mae wanted Jimmy to be able to work on the problems by himself in a class with other children, without a trainer giving him instructions for each move. Mae wanted Jimmy to give instructions to himself.

Mae wanted Jimmy to give himself a series of problem-oriented instructions each time he had to solve a new stimulus-matching problem. Here are the instructions Jimmy was to give himself:

Problem-Oriented instructions

Type	Self-instructions
Problem orientation	"What do I have to do first?"
Task statement	"I have to circle the words that have the same letters."
Guiding self-statement	"Not this one, so I won't circle it." or "This one, so I will circle it."
Self-acknowledgment	"Good job."

First of all, *covert behavior* is private behavior, behavior not visible to the outside observer. And the opposite, *overt behavior*, is public behavior, behavior that is visible to the outside observer. Talking to yourself vs. talking out loud? Mae planned to begin by training overt self-instructions and then move to covert self-instructions. They would start with overt self-instructions because the proper behavior could be observed and reinforced.

Eve was the trainer. She and Jimmy worked together in a private room next to the group classroom. At first, she used a standard one-on-one training program—modeling, reinforcement, specific feedback, and punishment: She ***modeled*** self-instructing as she solved the problems. Jimmy ***imitated*** her. She praised Jimmy's correct self-instructing (***reinforcement***). When he made a mistake, she gave ***specific feedback***, such as "You said the instruction right, but you didn't circle the right answer." If Jimmy made the same mistake again, she removed his pencil and turned her back for 5 seconds of ***time-out*** (***punishment***).

They didn't want the sight of Eve to act as an S^D for Jimmy's self-instruction, so during the last 10 minutes of each session, she stood behind him. And at the end of each session, Eve said to Jimmy, "Use the instructions you learned today to help you on your worksheets in Max's classroom."

The training worked well in the training sessions. Within five 20-minute sessions, Jimmy's matching accuracy rose from 1% to 86%.

Training for Transfer of Training

But that wasn't enough. During these same days of Eve's one-on-one training, Jimmy kept on attending Max's classroom with five other children. There he again worked on the same sort of letter-matching worksheets, but his accuracy remained low (2%) in spite of his good performance in the one-on-one sessions with Eve. No transfer of training. Eve and Max could already hear the bulldozers moving toward the Rosa Parks Academy. So could Mae, but she pretended not to.

"Jimmy's right on schedule," she told her two frantic apprentices. "I'm basing our intervention on the work that David Guevremont, Pamela Osnes, and Trevor Stokes did. We could go faster, but we need some baseline data to convince this mysterious, skeptical computer engineer that we're doing real applied behavior analysis here, too."

"For the next few days, Max, I want you to tell Jimmy to say the instructions that Eve taught him out loud while he does his work."

"But suppose Jimmy doesn't say the instructions?" Max asked.

"Good point. Let's also use a rule-governed analog to a punishment procedure. Suppose Jimmy scores less than 75% on a worksheet and also fails to say his instructions aloud. Then say to him, 'You'll have to do another worksheet, because you're not using your instructions enough.'"

The procedure worked. Jimmy's homework accuracy shot to 85% the first day Max asked Jimmy to self-instruct. It averaged 89% over a 12-day period, and it stayed about the same (94%) even after Eve stopped asking Jimmy to self-instruct (a return to baseline).

Training for Covert Self-Instruction

Then, for 3 days, Eve trained Jimmy to use covert self-instruction. She said, "Jimmy, I want you to say the instructions you learned to yourself, while you do your work." For the next 21 days Max told Jimmy to keep saying the instructions to himself, and it seemed to work: Jimmy's accuracy averaged 95% and remained about the same (98%) during the return to baseline, where Max stopped telling Jimmy to self-instruct (Figure 23.3).

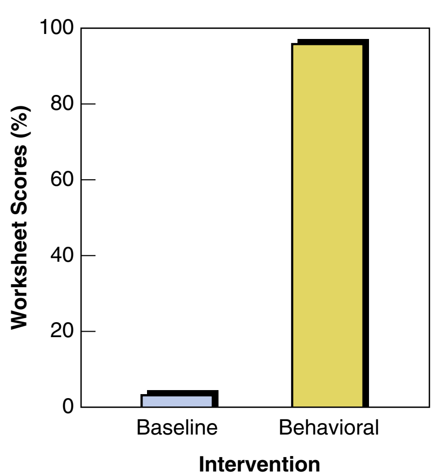


Figure 23.3 Transfer of Training From Lab to Classroom Using Self-Instructions

Analysis

Mae showed Jack Lewis a graph of Jimmy's excellent data, and Jack showed it to the mysterious, skeptical computer engineer. But the skeptic remained skeptical. She wanted more than a graph; she wanted to observe Jimmy herself. Mae feared that the presence of the extra adults in the classroom would disrupt Jimmy's performance. But she had no choice if she wanted to save her school.

On the day of the big test, a nervous Mae, a nervous Jack, and a calm but skeptical computer engineer sat in the back of Max's classroom and watched Jimmy work like a champ, raise his hand when he'd completed the assignment, and score 100%. Then the convinced computer engineer wrote a check for $500,000, made it out to the Rosa Parks Academy, smiled, and placed the check in Mae's shaking hand. Mae's mouth was so dry she had to try three times before she could say, "Thank you."

"How did you do it?" the computer engineer asked.

"First, we trained Jimmy to state a series of rules that told him how to do his assignment. And we praised him when he followed those rules," Mae, the behavioral engineer, nswered.

"Why didn't you just train Jimmy to do the tasks without bothering with the rules?" the computer engineer asked.

"Two reasons," Mae said. "First, with complex tasks, such as Jimmy's assignments, it seems easier to learn the rules and then prompt ourselves with the rules than to try to learn the tasks without the rules (but we need more data on this). And second, it may be easier to transfer rule stating from the training setting to the normal setting than it is to transfer the behavior the rules describe (but we need more data on this, too)."

Mae went on, "We also trained Jimmy to state the rules and follow them, even when he couldn't see the trainer. And in the group classroom, we gave him another rule, that he should say the problem-solving rules as he was doing his worksheets. We also told him the rule that he had to do an extra worksheet when he did poorly on one he'd just turned in. Finally, we told him the rule that he should say his problem-solving rules to himself, not out loud."

"Dr. Robinson, I like your style," the computer engineer said. "You work just like I do; you take nothing for granted. You nail down each tiny part of the procedure—detailed rules for problem solving, training with the trainer out of sight, instructions to state the rules in the group classroom, a rule for what happens to poor performance, and instructions to state the problem-solving rules to yourself."

"Thank you," Mae said.

"Frankly," the computer engineer went on, "I think most educators and human service workers take too much for granted. They don't worry enough about the details. And they don't get the results. It's a pleasure to see a real scientist in the classroom, Dr. Robinson."

Mae bowed her head slightly, acknowledging the compliment. Her hands finally stopped trembling.

There ain't no easy solution.

QUESTION

1. Describe a procedure for achieving transfer of training from one-on-one training sessions to group classrooms.
   a. Describe each step in the procedure.
   b. Describe the role rules play in each step.
   c. What were the general results?

OVERALL SUMMARY OF MAINTENANCE AND TRANSFER (G-22)

People have often been confused about the maintenance of performance and its transfer to novel settings. So let's address this confusion by reviewing this chapter.

Many confuse *stimulus generalization and response induction* with what we call *the maintenance and transfer of performance.*[9] *Transfer* occurs when performance in a test setting is similar to that established in a training setting. For example, the training setting might be the classroom, and the test setting might be the home. The behavioral intervention in the training setting might involve reinforcement or punishment contingencies, or it might involve analogs to reinforcement or punishment supported by rule control.

Transfer With Nonverbal Clients

Sometimes we intervene with nonverbal clients (e.g., Velma and Gerri, the two women with profound mental impairment who constantly ground their teeth).

How do we get transfer of training with these nonverbal clients? We must depend on simple stimulus generalization and response induction. The test setting must be at least somewhat physically similar to the training setting, and the test responses also must be at least somewhat physically similar to the training responses, if stimulus generalization and response induction are to occur.

Maintenance With Nonverbal Clients

And how do we get maintenance of performance with these nonverbal cases? We must maintain the contingencies of reinforcement or punishment as we did during the original training. We can do this in either of two ways:

1. Testing Similar to Training

Suppose the stimuli and responses in testing are so like those in training that stimulus generalization and response induction will occur (in other words, complete stimulus discrimination and response differentiation will never occur). (This happened with the blind and deaf Velma and Gerri and the bruxism → ice cube contingency.) Then, once in a while, we must return the clients to the training setting and training contingencies. That way we can give an occasional booster shot. In other words, this alternating between testing and training allows the reinforcement or punishment contingencies of training to continue to influence the performance and thus maintain that performance in testing. (This happened with Velma and Gerri, as occasionally reintroducing the ice cube punishment contingency suppressed bruxism even when no one was around.)

2. Testing Different From Training

But suppose the stimuli and responses in testing differ so greatly from those in training that stimulus generalization and will not occur (in other words, stimulus discrimination and response differentiation do occur), at least eventually. Then the maintenance of performance established in training will not continue in the testing conditions. In that case, to maintain performance in the testing conditions, we must make sure that reinforcement or punishment contingencies similar to those in training do occur in the testing conditions, at least occasionally. We can do this in either of two ways:

2a. Behavior Trap Sometimes the test setting will contain a behavior trap with natural contingencies that will automatically reinforce or punish the performance (e.g., Jungle Jim and the monkey bars).

2b. Added Contingencies But life doesn't always work out that simply. So sometimes we may need to add an occasional contingency in the test condition to maintain the performance (e.g., the grade-school students in the remedial classroom needed an occasional reprimand to maintain their performance).

What all this means is that there's no such thing as a free lunch. Performance doesn't maintain forever without supporting contingencies.

Transfer With Verbal Clients

Consider transfer of training following nonverbal interventions (e.g., with nonverbal clients). This must be simple stimulus generalization and response induction. In other words, here we get transfer because of a failure of stimulus discrimination and response differentiation. If we had tight stimulus control, we wouldn't get transfer of training.

But, fortunately, that's not so with verbal interventions. Verbal clients can learn rules in training and then use those rules to govern their behavior in testing settings. They can use those rules in novel testing settings, though they can discriminate perfectly between the training and the testing settings and though they can differentiate perfectly between the training and testing responses (e.g., the developmentally delayed men who learned street safety skills).

Maintenance With Verbal Clients

Rule control also may help us maintain our performance in the absence of natural direct-acting contingencies of reinforcement and punishment. For example, in the general training life provides us, we learn the rule that if we don't pay our taxes we're in deep dung. And in the annual test life provides us, we make the avoidance response (pay our taxes) each time, though Uncle Sam has never thrown us in jail. We have almost no experimental work and little theoretical work on this topic, but it does seem likely that rule control helps to maintain certain behaviors.

The following table gives a summary:

First Summary Comparison and Contrast: Transfer and Maintenance With Verbal and Nonverbal Clients

	Nonverbal	Verbal*
Transfer	Stimulus and response similarity	Rules
Maintenance	Behavior trap or added contingencies	Rules

In looking at this table, understand that *maintenance* means maintenance of the effects of training. It might not always mean maintenance of a high frequency of responding. For example, we might want to maintain the effects of a punishment contingency used in training. In that case, we'd want to maintain a low frequency of responding. Also, the nonverbal features can also facilitate transfer and maintenance for verbal clients, but they are less crucial, at least for transfer.

* Of course, the procedures for nonverbal clients can also work with verbal clients.

This is so complex; let's do one summary of transfer of training with and without language:

Second Summary Comparison and Contrast: Transfer and Maintenance With Verbal and Nonverbal Clients

Without Language	With Language
You can't have rules. So the training and the testing settings must be physically similar, to get transfer of training.	You can have rules. So the training and testing settings need not be physically similar, to get transfer of training.
In other words, you need much stimulus generalization and little stimulus discrimination.	In other words, you don't need much stimulus generalization; you can get transfer, even if you have much stimulus discrimination.
That was the case with nonverbal Gerri and Velma. Because they were deaf and blind, they could not discriminate between training and testing conditions. So they had excellent maintenance and also transfer.	That was the case with the verbal clients receiving the street-crossing training, where the model in the training setting was much different from the real street crossing setting. In spite of the obvious differences, they had excellent transfer. Maintenance wasn't addressed.

QUESTION

1. Compare and contrast transfer and maintenance with nonverbal and verbal clients:
   a. Construct and fill in the first summary table and describe its significance; *know how to do this even if the labels are in a different order*.
   b. Give an example of each aspect of the table.

Very Advanced Enrichment Section

I'M RIGHT AND EVERYONE ELSE IS WRONG

OK, I've spent 30 or 40 hours reading, writing, and worrying about the following: What terminology should we use for this chapter, as we update it for the 8th edition? And we've decided to use the terminology that's conceptually clearest, that will make it at least a little easier for you to understand the analyses needed to clarify what's really going on with a complex instance of transfer of training, like Terry's safe street-crossing transfer of training with a model. And now for the bad news: Out in the real world of the BCBA, they now use *response generalization* instead of our more traditional *transfer of training*. The problem is that *response generalization* implies *response induction*, transfer because of similar physical stimulation among different responses, like Rudolph's reinforcement for pressing with 11 grams of force transferring to 10 and 12 grams.

But the BACB and many applied behavior analysts are talking about Skinner's concept of *response class*—different responses having the same consequence. What they mean by *response generalization*, for example, is that, when one response produces a positive reinforcer, a physically different response will also increase in frequency, if it produces that same reinforcer, that is, belongs to the same response class.[10] For example, you say, *Mama, I loved your delicious chicken*; and she gives you a reinforcing smile, instead of her usual punishing frown. And that smile increases the frequency of your saying things like, *Mama, your cheesecake chewie was the most scrumptious I've ever had*. Not physically similar responses; so, in this book, we wouldn't call that *response generalization*. Instead, we say those two statements are functionally the same, the same *response class*, almost obsequiously polite behavior which Mommy will probably also reinforce. But many, perhaps most, behavior analysts would call your increased frequency of Mommy compliments *response generalization*. Please be prepared when you get out there in the real world.

Also, I just realized that when the BACB asks us to *use procedures to promote stimulus and response generalization* (G-21), they don't only mean *transfer of training* across responses but also across stimuli. And that also suggests a simple, basic process—*stimulus generalization*—but, in fact, it will often involve a much more complex set of processes underlying the desired *transfer of training*, as we've seen in this chapter. And the BACB and many other applied behavior analysts would be happy if you used procedures that involved much more complex processes than simple stimulus generalization and simple response induction. The authors of this book would be happy, too, though we'd hope you'd also be able to discuss the complex underlying behavioral processes, as we've discussed them in this chapter.

By the way, it turns out there's a bit of a debate among behavior analysts about how to use these terms (see page 720 of the White Book[11]).[12] And if you seriously want to dig deeper into this issue, you should check out Tim Ludwig's article.[13]

Notes

1 Based on Johnston, M. K., Kelly, C., Harris, F. R., & Wolf, M. M. (1965). *An application of reinforcement principles to the development of motor skills of a young child*. Unpublished manuscript.

2 Based on Baer, D. M., & Wolf, M. M. (1970). The entry into natural communities of reinforcement. In R. Ulrich, T. Stachnik, & J. Mabry (Eds.), *Control of human behavior* (Vol. 2, pp. 319–324). Glenview, IL: Scott, Foresman.

3 Based on Nedelman, D., & Sulzbacher, S. I. (1972). Dicky at thirteen years of age: A long-term success following early application of operant conditioning procedures. In G. Semb (Ed.), *Behavior analysis and education*. Lawrence, KS: University of Kansas, Follow-Through Project.

4 Based on Risley, T. (1965). Personal communication.

5 Based on Wallace, I., & Pear, J. J. (Intro.). (1977). Self-control techniques of famous novelists. *Journal of Applied Behavior Analysis*, *10*, 515–525.

6 Based on Page, T. J., Iwata, B. A., & Neef, N. A. (1976). Teaching pedestrian skills to retarded persons: Generalization from the classroom to the natural environment. *Journal of Applied Behavior Analysis*, *9*, 433–444.

7 Centers for Disease Control and Prevention. (2020, March 6). *Pedestrian safety*. Retrieved from www.cdc.gov/motorvehiclesafety/pedestrian_safety/index.html

8 Based on Guevremont, D. C., Osnes, P. G., & Stokes, T. F. (1988). The functional role of preschoolers' verbalizations in the generalization of self-instructional training. *Journal of Applied Behavior Analysis*, *21*, 45–55.

9 We use *transfer* rather than the more common *generalization* in this context to reduce the confusion. For an earlier use of *transfer of training* within this context, see Kazdin, A. E. (1975). *Behavior modification in applied settings* (pp. 212–228). Homewood, IL: Dorsey Press.

10 Cooper, J. O., Heron, T. E., & Heward, W. L. (2020). *Applied behavior analysis* (3rd ed., pp. 718–719). Hoboken, NJ: Pearson Education.

11 Ibid.

12 Geller, E. S. (2002). From ecological behaviorism to response generalization. *Journal of Organizational Behavior Management*, *21*(4), 13–38.

13 Ludwig, T. D. (2002). On the necessity of structure in an arbitrary world: Using concurrent schedules of reinforcement to describe response generalization. *Journal of Organizational Behavior Management*, *21*(4), 13–38.

PART XIII

Verbal Behavior

CHAPTER 24

Verbal Behavior

Behavior Analyst Certification Board 5th Edition Task List Items

B-14.	Define and provide examples of the verbal operants.	Throughout
B-15.	Define and provide examples of derived stimulus relations.	Pages 440–444
G-11.	Use Skinner's analysis to teach verbal behavior.	Pages 428–436
G-12.	Use equivalence-based instruction.	Pages 438–444

Introduction (G-11)

Remember Skinner, that guy from way back in Chapter 2, the guy who put Rudolph the Rat in the Skinner box, the guy who teamed up with Rudolph, to start this whole field of behavior analysis? Well, a few years later, that same guy wrote a book which would seem about as far away from Rudolph as you could get. He wrote a book called *Verbal Behavior*[1] about human language, yet he attempted to explain human language in terms of the concepts he got from his little lever-pressing friend, Rudolph. That should make behavior analysts very happy, but it didn't. The problem was, Skinner didn't have any data—he hadn't done any experiments to prove that we could understand human language in terms of his basic concepts of behavior analysis. And we behavior analysts are proud of the fact that we're scientists and that behavior analysis is a real science, just like physics, chemistry, and biology. And we're nervous about it too, because we're so new to this science game, and we don't want people confusing us with that old-fashioned psychology where psychologists just sat around and made wild guesses about how their invented concepts, like *mind*, caused us to do what we do and be what we be. If psychologists don't have experimental data, to heck with 'em. So essentially all behavior analysts ignored Skinner's new book and sort of quietly looked down their noses at it. But wait, there's more.

Remember that guy Jack Michael, also way back in Chapter 2, the guy who, with Ted Ayllon, wrote *The Psychiatric Nurse as a Behavioral Engineer*? You know, about Lucille, the restless resident, who kept wandering into the nurses' office, until they extinguished that inappropriate behavior? By the way, it happens that it was, more or less, the first experiment in applied behavior analysis; it was the article that started this whole field, ***applied** behavior analysis*. But also, Ayllon and Michael had a hard time getting their article published in the *Journal of the Experimental Analysis of Behavior*. Why? Because their experiment consisted of a series of different single-subject studies, not a series of exact replications with three different Lucilles wandering into three different nurses' stations. More or less, except for Ayllon and Michael, we behavior analysts hadn't yet figured out how to cope with single-subject studies, where each little study was somewhat different from the others, not exact replications. Well, that same Jack Michael fell in love with Skinner's *Verbal Behavior*.

And Jack was so persuasive that his grad students also fell in love with *Verbal Behavior*. Then they actually started doing real experiments with real people, experiments based on Skinner's *Verbal Behavior*, experiments that gradually came to convince behavior analysts that using Skinner's verbal-behavior concepts leads to an understanding of human language and that it's the way to help people who are having trouble learning to speak. And that's why we're going to dive into those concepts now. So, take a deep breath and dive.

By the way, for his very basic definition of verbal behavior, Skinner said it's *behavior reinforced through the mediation of other persons*.[2] Of course that's way simplistic, because Rudolph the Rat's lever pressing is reinforced by you (the *other person)* giving him a drop of water; but neither Skinner, nor you, nor I would consider Rudy's lever press to be verbal behavior. And over the years, Skinner went on to greatly refine his definition; but we'll stick with his first one, because that's what most behavior analysts use today; and we'll express more of our concerns later on in this chapter. On the other hand, if you wish, you can Google the heck out of *definition of "verbal behavior"*, which I just spent the morning doing.

Also, *verbal* doesn't mean just *vocal*. Very roughly, *verbal behavior* means using language, and that could be talking, but it could also be sign language, written words, telegraph, etc.; it's all verbal behavior.

QUESTION

1. *Verbal behavior*—give **Skinner's** original definition of it and explain why it is not the same as *vocal* behavior.
   a. Give an example of non-vocal verbal behavior.

Shreeya and the Primary Verbal Operants*,** (B-14)

THE FAMILY

Shreeya's father-to-be was an MD, a hematologist-oncologist. He was in Michigan, working on also becoming a PhD and doing a doctoral dissertation on serotonin receptors and PET imaging in children with autism (way above my pay grade), when he learned that he needed to return to India, where his parents had arranged a marriage for him with Shreeya's mother-to-be, an MD, a rheumatologist. Flying back to Michigan on the day after the 9/11 terrorist attack on the Twin Towers, they were required to lay over in Canada before being allowed to enter the United States.

* What's a *verbal operant*? It's a behavior-analyst way of talking about various functions of language in terms of operant conditioning, as you will see. It's based on Skinner's book, *Verbal Behavior*.

** Truth and Fiction: This is not exactly how we actually worked with Shreeya. In writing this chapter, we've modified the procedures somewhat, here and there, to bring them up to date with the way we're doing things now, based on more recent research and experience. But we did do essentially everything we've described, and she's made all the great progress we've described. So, this is sort of a docudrama. Oh, yes, and verbal behavior is just part of what we helped Shreeya with; we also did a lot of work on activities of daily living, like eating with silverware, hand washing, and toilet training. Also, many kids don't make the great progress that Shreeya did, probably because they don't get nearly as much early behavioral help as she did.

On May 10, 2006, they had a beautiful, little baby girl, Shreeya. But by the age of 2 1/2, she still hadn't learned to speak, neither their mother tongue, Telugu, nor English. This suggested autism. And because her father had done his dissertation on autism, he knew that behavior analysis provided the only effective help. But there was no applied behavior analysis where they lived in Michigan; so, on October 27, 2008, she was the first child to enroll in our brand-new, funky, little Kalamazoo Autism Center. And she rode 40 miles, each way, 5 days a week, to receive 8 hours a day of behavior-analysis help.

Vocal Behavior (Vocalization)

Shreeya had no language, not even speech sounds. In fact, all she did was squeal, not as an effort to talk, but just as a form of self-stimulation, like your singing in the shower. Now babies often start babbling by the time they're 6 months old. But not random babble. They babble in the language of their parents. They echo the speech sounds they hear from Mommy and Daddy. But not Shreeya, and not many kids with autism. Shreeya just squealed.

Why don't these kids babble? For some reason, the sounds of the parent's voice aren't a sufficient conditioned reinforcer that making those sounds will reinforce the baby's babbling.[3] (There's still too much we don't understand about how and when and why conditioned reinforcers do and don't work.)

But here's an auditory reinforcer that really did work for Shreeya, *All aboard! I've been working on the railroad, all the live long day*—just 5 to 10 seconds of the child version of this song. And what did she do when she heard this conditioned reinforcer? She danced to it—sort of a twist! She'd spent some time with Grandma back in India, and that may be why she was heavily into Bollywood dance videos (i.e., they were big reinforcers for her). She also got into imitating the dancers (i.e., she'd lift her feet, wave her hands, and wiggle-twist). And, yes, of course, *All aboard!* was not Bollywood.

So, our first goal was to get her making speech sounds; incidentally, maybe those speech sounds would replace her mildly annoying little squeals. So in the first phase, we reinforced any non-squealy sounds, whenever she happened to make them. (This wasn't discrete trial training; we didn't present an S^D and reinforce only when her sounds followed the S^D. It was free operant; whenever she made a non-squealy sound, she got a reinforcer, no cue or S^D involved.)

We reinforced any vocal sounds Shreeya made, anything except her dreaded squeal. But at first, we had to compromise, because all she was doing was that damned squeal. So we reinforced anything that wasn't quite a squeal. And as the not-quite squeals got more and more frequent, we raised our standards to reinforcing only when her vocalizations were hardly a squeal, and then not at all a squeal. In other words, we used shaping to get more appropriate sounds.

Then we started going for variety. Using shaping and differential reinforcement, after many 10-minute training sessions, Shreeya was doing *whee*, *guy*, and *oh* several times a minute; and it was time to move on to **echoics**.

Echoic (Vocal Imitation)

So, what are echoics? Vocal imitation. We wanted Shreeya to be able to echo (imitate) the sounds and words we were saying. If she can't do that, it'll be almost impossible for her to learn to talk. Therefore, we then did 20 echoic training sessions, where we'd say one of her three sounds, and give her a reinforcer when she echoed that sound.[4] She got it! Then we went on, training her to echo sounds she'd made less frequently and then completely novel sounds.

Definition: CONCEPT

Echoic*

- Imitation of the vocal behavior
- of another speaker.

Then we had different behavior techs do echoic sessions with her and in different settings to make sure that her echoic behavior generalized to sounds coming from different people in different places. That's the easy but often neglected part. This took about 8 hours total (94 5-minute sessions). Not bad. By the way, working with other behavior techs on other skills, she started spontaneously echoing *please*, *yay*, and *good job*.

(To briefly tech talk it, each of the three different sounds the techs said was an S^D; in other words, we had three different S^Ds. And we were training Shreeya to discriminate between the three different S^Ds and differentially reinforcing only her vocal response that echoed [imitated/matched] the S^D for that trial. So this also means we were doing discrete trial training, no longer free-operant reinforcement, no longer reinforcing whatever vocal response, whenever it occurred.)

(And to briefly people-talk it, some students are asking, *What's the difference between **echoic** behavior and plain **imitation**?* There is no difference. *Echoic* imitation is simply imitation of someone's vocal behavior, just like *motor* imitation of someone's movements, and what we call *manipulative* imitation of someone's rolling a toy car back and forth.)

(And one more thing: Suppose Mama's talking to Daddy, and Shreeya imitates something Mama said, is that an **echoic**? Yes, Mama doesn't have to be talking to Shreeya for us to classify her imitation as an echoic.)

Mand (Request)

Now we could move on to something Shreeya would actually use—teaching her to make requests, to ask for things. Skinner called this *manding*. He coined **mand** from *command* and *demand*, even though *request* sounds a little politer. Many children can't vocally mand and can only mand by pointing at what they want; but what can they do, if what they want's not in sight? Often what they do is whine, cry, bang their head on the floor—really—extremely violent, harmful behavior can be accidentally shaped up, if the kid can't vocally mand.

Definition: CONCEPT

Mand**

- A request for a reinforcer

Preference Assessment. First Dana, her behavior tech, did a preference assessment to make sure we had four effective reinforcers. Dana put several potential reinforcers on a table and let Shreeya select one. Then she could select a second, from the remaining three, then a third, from the remaining two, and finally fourth, the only one left, the least preferred, the loser. This is called a ***multiple-stimulus, without replacement preference assessment***. They ended up with Cheez-its, Sour Patch Kids, Fruit Snacks, and Skittles as the reinforcers they'd use in her mand training.

* The more traditional definition of "echoic" is: "Verbal behavior in which the response is vocal and controlled by a prior auditory verbal stimulus, there is point-to-point correspondence between the stimulus and the response, and there is formal similarity between the prior stimulus and the response-product." Find these definitions and more at FoxyLearning.com.

** The more traditional definition of "mand" is: "Verbal response in which the form of the response is controlled by an establishing operation" (via FoxyLearning.com). Also, note that the request could be either for positive or negative reinforcement, like *Please turn down that damned air conditioner!*

Mand Training. Then Dana started teaching Shreeya to mand.

a. She'd hold up one of the reinforcers and immediately say its name. If Shreeya **echoed** an approximation to the name, she'd immediately get the reinforcer. Also, once in a while, Shreeya would independently say her approximation of the name of one of the reinforcers between trials, even though Dana hadn't yet held up one of the reinforcers or provided the echoic prompt. And of course, Shreeya would immediately get what she'd manded for.[5]
b. Also, Dana systematically **shaped** Shreeya's **pronunciation** of her mands until her echoics were close enough that anyone could understand her. (At this point Dana only tried to get the first word in the mand, just *Sour* and *Fruit*.) After the formal shaping her pronunciation continued to get better and better.
c. Once Shreeya was reliably responding to the echoic prompts, Dana would hold up the reinforcer and wait 5 seconds before providing the echoic prompt. So if Shreeya responded as soon as Dana held up the reinforcer, she'd get it 5 seconds sooner. In other words, Dana was **fading out the prompts**. And Shreeya did learn to mand for the four reinforcers, without echoic prompts.
d. Then Dana did correspondence training to make sure Shreeya was not just saying one of the mands she'd been trained on but that she was manding for what she actually wanted. Dana would put all four reinforcers on the table, and if Shreeya manded for one item but tried to reach for a different one, Dana would provide an echoic prompt for item that she reached for. It only took a couple sessions for Shreeya to mand for exactly what she "wanted."
e. **Manding for reinforcers that are out of sight**. But Dana and Shreeya still weren't done. Shreeya needed to learn how to mand for things that weren't in sight. So Dana put five of each reinforcer in a box with a transparent lid that Shreeya could see through, and then she'd start the manding sessions again. Next Dana covered the lid so Shreeya couldn't see the reinforcers, but she kept manding and kept getting what she manded for.
f. **Not-now training**. Whenever they ran out of one of the reinforcers, Dana would say, *not now*, and would *not* reinforce even the slightest or most exaggerated whimper—**extinction** city. This way Dana was decreasing the chance that the frustration of not getting a manded reinforcer would escalate into major aggression, which can happen if you're not as careful as Dana was.

More. During this phase of Shreeya's verbal-behavior training, Dana went on to teach Shreeya nine more mands in only 14 more 10-trial sessions. In addition, the other techs reinforced these mands during the remainder of her 8-hour day at our Kalamazoo Autism Center.[6]

Before we move on to other types of verbal behavior, let's also remind you that back in Chapter 13, Jimmy was learning to mand by showing people pictures of a reinforcer he wanted—the Picture Exchange Communication System (PECS). And we've found PECS very helpful in working with children who are not ready to mand vocally.

Listener Behavior (Receptive Identification) *

OK, so Shreeya has learned to echo—important for learning more advanced verbal behavior. And she's learned to mand—important for requesting reinforcers. Now it's time to move on to another type of verbal behavior—**listener behavior**. You say something, and the listener "understands" it—responds correctly to what you've said. And much listener training involves responding correctly to someone else's mands.

Definition: CONCEPT

Listener behavior

- Behavior under the stimulus control
- of a speaker.

Standard Procedure. Back in the day, when Kelly T. Kohler was a behavior-analysis grad student, she worked with Shreeya on this. She started with the standard approach of putting three objects on the table and saying the name of one of the objects. Then when Shreeya touched the object, Kelly would give her a reinforcer, like an M&M. And if she didn't touch the correct object or just sat there, Kelly would prompt the correct response, either by just pointing to the object or providing gentle physical guidance. But that wasn't working well, so Kelly had to get very innovative.

Matching-to-Sample Prompts. Shreeya had become the matching-to-sample queen. You know, hold up a sample stimulus, a picture of a car, and she'd immediately touch the comparison picture on the table, the car, not the doll, not the trike. And more than that, you could use a set of pictures she'd never been trained on, and she'd nail it. In other words, she had generalized matching-to-sample.

* Skinner did not consider listener behavior to be one of the "verbal operants," but we, along with some others, think it's so crucial to the flow of this analysis and language learning that we're including it here.

Therefore, Kelly created a matching-to-sample prompting procedure[7] where she'd hold up one card, but Kelly would also say its name, e.g., *car*, and Shreeya would immediately touch the picture of the car on the table. No problem, of course. But then Kelly gradually faded the picture on the sample card until Shreeya could barely see it. The hope was that as the sample pictures got fainter and fainter, more and more difficult to see, Shreeya would start attending to the word Kelly was saying (that the stimulus control would shift from the sample picture to Kelly's spoken word, that Shreeya would be learning receptive-language discriminations, often called *receptive identification*). And that is what happened; it worked! When Kelly held up a blank card, no picture, and said the name, Shreeya would touch the picture that matched the name Kelly had said, even after she stopped holding up any card and just said the name. After learning a few receptive identifications based on word-picture combos, using Kelly's matching-to-sample prompt fading, Shreeya could quickly learn many more receptive identifications. She was on the road to becoming a listener, the receptive identification queen, an even bigger deal than being the matching-to-sample queen. Whew!

Listener Behavior (Following Instructions)

But that wasn't nearly enough, not just receptive identification. Shreeya need to learn to follow many more instructions, like *come here*, *sit down*, *give me the ___*, *get the ___*, *go to the ___*, and eventually the much more difficult *go to the (e.g., kitchen) and get the ___*. And she did learn all of the listener language skills, in spite of our sometimes making the common mistake in teaching instruction following.

The common mistake is to look in the direction we wanted her to go, or make a sort of come-here sign when we wanted her to come here, or make a patting-the-chair sign when we wanted her to sit down. I'm not talking about a prompt that we'd eventually fade out, but rather we all have a tendency to give those unintentional visual prompts when we're so eager to encourage the child to comply with our instructions. The problem with that is, the child learns to respond to the visual "prompts" and fails to learn to respond to the auditory instruction. Fortunately, we were able to repair all of our errors, along the way.

Shreeya made good use of her echoic skills, as she was learning to follow ***multiple-step instructions***, to *go to the kitchen* or *closet and get the milk* or *plate* or *hat* or *shoes*. She'd echo *milk* repeatedly until she got to the kitchen, and then her saying *milk* would be the S^D for her getting the milk and bringing it to us. After more training, she stopped echoing *milk*, etc., out loud (overtly), but we suspect she continued echoing the instruction to herself (covertly) for a while; eventually, like you and I, she probably no longer even needs to echo the instruction at all.

That reminds me: When I was a 4-year-old, Mommy sent me to the neighborhood grocery store to get a pound of butter. Which I did, barefoot (that's the way it was back in the day). But I stubbed my toe. So I walked into MacKinsey's grocery with what we might call *a corrupted echoic*: *Stubbed my toe and a pound of butter. Stubbed my toe and a pound of butter. Stubbed my toe and a pound of butter*. Such a cute little boy, at least Mommy and Mrs. MacKinsey thought so, and Mommy got her pound of butter.

And it also reminds me of how cool you and I are, now that we are "mature" adults, but no longer that cute. Like, we park our car in the parking lot, "mentally note" (covertly say to ourselves) where in the lot we've parked it, go to class, leave class, and then ask ourselves, *Now where did I park that damned car?* Answer our own question, and then go to our car—at least most of the time. Fairly impressive, when you stop and try to analyze what we've managed to do, instead of just taking our humble little accomplishments for granted.

Tact (Expressive Identification, Labeling)

Single Word Tacts. But enough about us; let's get back to Shreeya. We not only wanted her to be able to respond to instructions, but we also wanted her to be able to tell us things. And telling people things usually involves labeling things, like,

I ate a Big Mac today.

Ate **tacts** (labels) what she did.

Big Mac **tacts** (labels) the object.

Today **tacts** when she did it.

And I almost forgot, *I* **tacts** who did it.*

Definition: CONCEPT

Tact**

- Labeling a stimulus.

* Notice how I so subtly transitioned you from standard English, *label*, to behavior-analytic English, ***tact***. They mean essentially the same thing. *Name* would have been an even better translation of *tact*, but we behavior analysts have a different use for *name*, which we'll soon get to. (Skinner derived **tact** from con**tact**. We behavior analysts seem to have had a knack for inventing behavioral terms that are not too easy to understand at first glance, as you've probably noticed.)

** The more traditional definition of "tact" is: "A verbal response controlled by a non-verbal stimulus" (via FoxyLearning.com).

So Kelly started teaching expressive ID-ing (tacting) by holding up an item (e.g., doll, shoe, and plate) and immediately providing Shreeya with a verbal prompt (e.g., she'd say *doll*). Because Shreeya had excellent echoic skills by now, she usually echoed Kelly's model, which Kelly immediately reinforced. Then, Kelly increased the delay between holding up the item and saying the prompt.* Occasionally, Shreeya would label (tact) the item before Kelly prompted her to do so, which got her the reinforcer more quickly. Eventually, Shreeya was reliably beating Kelly to the prompt and tacting (labeling) items independently.

And Kelly taught her more and more tacts, teaching her to label a variety of people and objects in her environment, then on to teaching her to tact actions. As she learned more and more tacts, Shreeya would only need a few prompts before she'd learn the new tacts. Pretty cool. Eventually Kelly even taught her some noun–verb tacts, like *baby crying*.

Full Sentence Tacts. Then we went for more complex tacts—sentences. *Kelly kisses cat. Lisa hugs Diego*. And, *Jenn feeds baby*. First, Shreeya could tact the individual subjects, actions (verbs), and objects. Then Kelly showed her 3-second videos of Kelly kissing cat, Lisa hugging Diego, etc., and she taught her to tact those three episodes with the basic sentences. Great. We'll tell you more about how she did this in minute, so stay tuned.

Of course, Kelly was reinforcing Shreeya's correct tacts, but just because Shreeya's verbal behaviors were being reinforced, that didn't mean those behaviors were also mands. They weren't; she wasn't requesting a reinforcer. And generally, when we mand, we're requesting a specific reinforcer. But of course, tacting can sometimes be a little mand-ish, like *Mommy, look at that ice-cream cone that little boy is eating!*

Textual (Reading)

When Shreeya was about 3, a behavior-analysis undergrad, Annah Wisotzkey, was her babysitter. She noticed that Shreeya could ask for food items by saying the letters she would see on the food packages. So after Shreeya's regular sessions at our Kalamazoo Autism Center, Annah would conduct her own bootleg reading sessions, before taking her home. She made sight words, and Shreeya quickly learned to read them. Then came her brand-new iPad which sucked her into its games and sight word apps. And when Annah and Shreeya got home, they weren't done with the reading instruction. In addition to all of this, we also used an impressive computer-based program, *Headsprout*, to help Shreeya learn to sound out words; but unfortunately, we didn't get to the comprehension parts of *Headsprout*.[8]

* This type of prompt is called a ***time delay***.

Textual (Reading) Comprehension

While she continued to have extensive in-home behavior-analytic help, at the age of 7 Shreeya moved from our Kalamazoo Autism Center to a private school, the Gagie School, where she was way above her grade level in one component of textual behavior: She could read stories out loud better than most of the kids her age, but if you asked her any questions about what she'd just read, she couldn't answer them. She didn't "understand" ("comprehend") what she was reading. In other words, she only had part of what we mean by textual behavior (reading).

So during the last couple of years, Shreeya's been working on her reading with behavior-analysis grad students, Margo Uwayo and Brandi Fontenot. They explicitly reinforced Shreeya's comprehension behavior. They'd take turns reading a story out loud, and they would frequently ask questions about the stories as they were reading them. Also, for independent reading, Shreeya would silently read stories and then read the questions out loud, followed by her writing her answers on a worksheet. Of course, Shreeya got her share of praise for her correct answers, which she deserved because she was hitting 80% to 90% correct, with a mean of 107 correct words per minute, and ending in the top 25th percentile of fifth-grade readers!

Transcription (Writing)

At our center, behavior-analysis grad students started training Shreeya to do very simple writing, though the details are lost in the hazy past. And somewhere along the line, Shreeya picked up one-finger typing, probably on her iPad. Then at the Gagie School, she got a lot of practice with her handwriting, so that now she has excellent printing, though her cursive isn't too good (hopefully better than mine), and she has some trouble spacing between words and capitalizing the first words of sentences; but that's not bad, really.

QUESTIONS

1. *Echoic*—define it and give an example.
2. *Mand*—define it and give an example.
3. Describe the mand-training procedure Dana used to teach Shreeya to mand.
4. *Listener behavior*—define it and give an example.
5. *Tact*—define it and give an example.
6. Describe the tact-training procedure Kelly used to teach Shreeya to tact.
7. What are the behavioral terms for reading and writing?

SHREEYA AND THE COMPLEX VERBAL OPERANTS

Generative Verbal Behavior[9]

So far, it's cool that we were able to teach Shreeya all these primary verbal operants and that she was able to say them, and at the right time, and in the right place. Remember, when she first came to the Kalamazoo Autism Center at the age of 2 1/2, all she could do was squeal a little. And now she can say simple sentences. But wouldn't it be really great if we could use behavior analysis to help her learn how to say novel sentences, original sentences she'd never heard before?

Kelly started working on that goal by teaching Shreeya three 3-word sentences, with three subjects (*Kelly*, *Lisa*, *Jenn*), three verbs (*kisses*, *hugs*, *feeds*), and three objects (*cat*, *Diego*, *baby*)—the three gray squares in the following table. She taught: *Kelly kisses cat, Lisa hugs Diego, and Jenn feeds baby*. She taught the original three-word sentences as tacts to little videos, of Kelly kissing a baby, etc. But remember that 3 × 3 × 3 = 27. So those nine words, those nine simple tacts, could be combined to form 27 different sentences, complete sentence tact.

KELLY				***LISA***				***JENN***			
KISSES	**Kelly kisses cat**	Kelly kisses Diego	Kelly kisses baby	***KISSES***	Lisa kisses cat	Lisa kisses Diego	Lisa kisses baby	***KISSES***	Jenn kisses cat	Jenn kisses Diego	Jenn kisses baby
HUGS	Kelly hugs cat	Kelly hugs Diego	Kelly hugs baby	***HUGS***	Lisa hugs cat	**Lisa hugs Diego**	Lisa hugs baby	***HUGS***	Jenn hugs cat	Jenn hugs Diego	Jenn hugs baby
FEEDS	Kelly feeds cat	Kelly feeds Diego	Kelly feeds baby	***FEEDS***	Lisa feeds cat	Lisa feeds Diego	Lisa feeds baby	***FEEDS***	Jenn feeds cat	Jenn feeds Diego	**Jenn feeds baby**
	CAT	***DIEGO***	***BABY***		***CAT***	***DIEGO***	***BABY***		***CAT***	***DIEGO***	***BABY***

(Got it? No? Well, reread the previous paragraph, check over this table, and think about it for a couple moments.)

And it turns out that when Kelly showed Shreeya a novel video, consisting of components she'd seen in the three training videos, Shreeya nailed it: She'd say, *Kelly feeds Diego*—a brand new sentence she'd never heard nor said before, describing a video she'd never seen before. Wow!

Not only that, but when Shreeya saw new videos she'd never seen before, with single word tacts she'd mastered but never heard nor used in a sentence, she could do it. She could say brand new sentences tacting (describing) brand new videos, with no sentence training using those words.

Shreeya had mastered **generative verbal behavior**. And some of us think that this is the essence of language. It's one thing to teach *Polly wants a cracker* or *I want a Cheeto*; that's cool, but generativity may be the defining feature of verbal behavior, what it takes for behavior to really be verbal, and that's *very* cool. At least that's what some of us think.

But what the heck do we mean by *generative verbal behavior*? We mean original, novel verbal behavior. Verbal behavior that hasn't been directly trained, though it can be the novel combinations of component behaviors that have, themselves, been trained.*

* True confessions: In the decades I've written and thought about generative verbal behavior, I've always thought in terms of novel, or original, spoken and written verbal behavior. But it was only this morning, when I was Googling *generative verbal behavior*, that I ran across the embarrassingly obvious notion that *generative verbal behavior* also includes listening to and reading novel sentences, not just speaking and writing them.

Definition: CONCEPT

Generative verbal behavior

- Novel verbal behavior
- that has not been directly trained.

OK, we've been talking about **verbal behavior** for quite a few pages, but we haven't formally put it in one of the official boxes; so here goes. And as we said earlier, this is Skinner's definition:

Definition: CONCEPT

Verbal behavior[10]

- Behavior reinforced through
- the mediation of other persons.

And what did Skinner mean by *mediation of other persons*? He meant *reinforced by other persons*, like when you say, *I'll have another beer, please*, and the bartender reinforces that verbal behavior with a beer reinforcer. Or you say, *That was an exquisite beer*, and the bartender reinforces that verbal behavior with a big social reinforcer, *I can see you're a person of very sophisticated taste*.

But I'll confess, I've never been too happy with this definition of Skinner's, because, as another person, you ***mediate/reinforce*** Rudolph's lever pressing with a drop of water, but none of us, including Skinner, would argue that a rat's lever pressing is verbal behavior. Of course, Skinner later puts many more constraints on his first definition that would rule out Rudy's lever pressing as verbal; but you'll have to dig pretty deeply into his book, *Verbal Behavior*, to find them.

(**This just in:** Turns out many of our students want to include Rudolph's lever pressing for water as *verbal behavior*. And yes, it meets Skinner's definition of *verbal behavior* and of *manding*; and if that makes you happy, stick with it, though your teacher probably won't agree with you. But I think that misses the important feature of *verbal behavior*—mainly that *verbal behavior* is *language* (*talkin'*, *writin'*, etc.). And if you're the kind of person who says to Rudolph, *Talk to me brother*; and then when he presses the lever, you joyfully shout, *Now you're talkin'!*, OK, go for it. But I'm not with you on that one. And if you stick with blind faithfulness to Skinner's definition, does that mean you can't talk to yourself, because another person isn't giving you an M&M for doing it? Well, Skinner didn't seem to think so, because he wrote about speakers being their own listeners.)

On the other hand, to me the crucial or defining feature is that **verbal behavior is generative**. And I think verbal behavior (i.e., language) is the only behavior that is generative. But most behavior analysts still stick with Skinner's original definition, so you should be on top of it too.

(**This also just in:** There still seems to be some confusion between **verbal** and **vocal** behavior. Well, not all that's verbal is vocal, e.g., texting your friend on your iPhone. And not all that's vocal is verbal, e.g., little 2 1/2-year-old Shreeya's squeals.)

QUESTION

1. Describe the procedure Kelly used to teach Shreeya to say new sentences she had never spoken or heard before.
2. Define *generative verbal behavior* and explain how it is more than just *verbal behavior*.

The Autoclitic

Essentially, autoclitics are modifiers, like adjectives and adverbs. Shreeya might mand, *Candy*. And Mama might ask, *What kind of candy?* And Shreeya would reply, *Chocolate candy*. *Chocolate* is an adjective.

But autoclitics are more general modifiers. They can even modify sentences, like the sentence *Behavior analysis rocks*. You might modify that sentence, by saying, ***I know*** *behavior analysis rocks*. Or, ***I think*** *behavior analysis rocks*. Or, ***I'm not so sure*** *behavior analysis rocks*.

Or you can even modify the sentence by shouting it, *Behaviorism rocks**!!!***

The point is, we can use some of our verbal behavior to modify how a listener or reader will respond to another part of our verbal behavior.

Definition: CONCEPT

Autoclitic*

- A verbal operant that
- modifies the effect of
- other verbal operants.

And Shreeya also learned to use autoclitics. In other words, after she learned to tact a lot of things and events, she also learned to modify them. Like she not only could tact *Apple*, but she eventually learned to tact ***Red*** *apple*. The adjective *red*'s the autoclitic. But cooler than that, she came to be generative with her autoclitics; she could do novel tacts, like *Red* ***car***. But even cooler than that, she could use an autoclitic she'd learned while tacting, when she was doing something much more important to her than tacting, when she was manding, like, *Red* ***dress***. Yes, Shreeya was just a little fussy about her clothes, so when Mama got her the *blue* dress, she could make it quite clear it was the *red* dress she was manding for. So, she had autoclitics that were not only generative across sentences but also across verbal operants, in other words, between tacts and mands.

QUESTION

1. *Autoclitic*—define it and give an example.

Intraverbal

An **intraverbal** is a verbal response to a verbal stimulus:

Kelly: *What's your name?* **Shreeya**: *Shreeya*.

Kelly: *Mary had a little ____?* **Shreeya**: *lamb*.

Kelly: *Shreeya, what are you doing?* **Shreeya**: *Eating lunch*.

Kelly: *What are you eating?* **Shreeya**: *Macaroni and cheese*.

Kelly: *Do we have time to teach Shreeya another intraverbal, today?* **Kelly**: *Yes, I think we do!* This example is also an **intraverbal**, except this time the speaker is responding to her own verbal behavior (and that's something not usually mentioned when considering intraverbals.)

* The more traditional definition of **autoclitic** is: "Secondary verbal behavior to the speaker's primary verbal behavior that alter the effectiveness of the primary verbal behavior or the reaction the listener takes with respect to the primary verbal behavior. Autoclitic responses depend on other verbal behavior."

Dick: *Really into some cool Netflix*—The Good Witch, Gilmore Girls, and on and on. . . *And on Amazon Prime,* Bosch *breaks my heart, because it's so well done that I struggle not to binge it*. And still more on and on. . . . **Kelly**: *I'm glad you're so productively engaged during this coronavirus stay at home*. And this is another **intraverbal**, because Kelly is tacting her own emotional state in response to Dick's endless verbal stimulus, but that tact is the reinforcer for his incessant verbal behavior.

Conversations may be our most interestingly complex forms of intraverbal behavior. For instance, what are the reinforcers for conversing? In listening to the conversing behavior as I Zoom with my coronavirus-stay-at-home friends and colleagues, I'm seeing that the conversation reinforcer for them is not so much hearing the brilliant stuff I have to say as it is their getting an occasional, polite acknowledgement from me for what they have to say. In other words, the pandemic stay-at-home depression that's sweeping our great nation is not so much not being able to see and hear friends, but rather, not getting a few mild social reinforcers from those friends. And it's not the common notion of finding it reinforcing to *hear yourself talk*; instead it's the intermittent, mild acknowledgement from others for your talking. And I'll confess that I'm impressed by the amount of effort I'll put into coming up with a couple of brilliant points to make in my next conversation or Facebook post, so that I'll get an occasional acknowledgement or Facebook like.

Definition: CONCEPT

Intraverbal

- A verbal operant
- under the stimulus control of
- other verbal operants.

QUESTION

1. *Intraverbal*—define it and give examples.

INTERMEDIATE ENRICHMENT

Ok, hold on to your hat; this *Intermediate Enrichment* section ain't easy.

So Shreeya's got some generative verbal behavior—she can understand and say sentences she's never heard or said before.

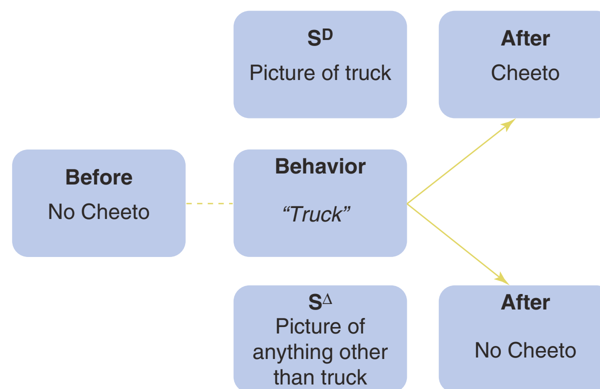
But here's another goal: Wouldn't it be cool, if we could just say to her, *This is a dog*, and then a little later we'd point to the dog, ask her what it is, and she'd say *Dog*. Of course most kids you know can do this by the time they're 3, but not Shreeya, and not most of the kids we work with. So, if we want her to tell us what it is, we have to explicitly teach her to tact it; we have to go through a bunch of reinforced discrete trials where we ask her, prompt her, fade out the prompts, reinforce all her correct responses, and then she's got it, then she can tact the dog, she can say *Dog* when we show it to her. And just because we taught her to tact *Dog* doesn't necessarily mean that she could now also point to a dog when we ask her to, as most kids her age could do.

Therefore, another grad student, Chase Callard, took this on. He did some more **receptive identification training** with our little receptive-language queen, like Kelly had done. But the crucial thing is, Shreeya was now echoing very reliably. So, Chase would say *truck* and Shreeya would touch the truck-picture comparison stimulus and not the picture of the chair or the walnut. But he hoped that she'd also echo *truck*, either overtly (out loud) or covertly (to herself). And after a few sessions of this receptive identification training, he'd hold up one of the pictures, for example the truck, and ask, *What's this?* and hold his breath in hopes that she'd tact it (label it), that she could expressively identify it; and she did, she did tact it; she did say, *truck*! And on and on. She could do it! We could teach her the name of something (with our receptive identification training) and then she could tell us, she could tact it, without the additional tact training (expressive identification training) that Kelly'd had to do earlier! This receptive-to-expressive identification training was working!

Also, expressive-to-receptive identification training was working. We could teach her to say *plate* when we held up a picture of a plate (expressive identification), and then she could point to the plate or give us the plate, when we asked her to do so (receptive identification).

I know what you're thinking, like what's the big deal, why'd you have to put all those !'s in the previous paragraphs, why is this such a breath-holding episode? Because Shreeya was on her way to being able to learn like most kids can learn, like you and I learn—just tell her and she's got it, more or less. And over time, Shreeya got better and better at this.

Now, just why does this work; why are Shreeya, you, and I able to learn this way? Well, here's our effort at an answer: In her original training, Chase might have just told her, *this is a truck*, and she'd have echoed *truck*. But he wanted to make sure she was both listening to what he said (the vocal sample stimulus) and also looking at what he showed her (the picture comparison stimuli). For her to make the correct selection response and get her reinforcer, she had to be paying attention* both to what Chase said and to the pictures. OK? But also, he was assuming that correctly echoing what she heard was a big enough reinforcer, in itself, that he'd not have to explicitly reinforce her echoes. OK? And now for the biggest jump: For this to work, the picture of the truck (the comparison stimulus) must become the S^D for her verbal response, *truck*. But for this operant conditioning to occur, Shreeya must be getting a reinforcer. So we think it may go like this: Shreeya's looking at the picture of the truck (because of the receptive-identification training), and she's making the covert, vocal response *truck*, and it just so happens that a reinforcer follows that response. And even though that reinforcer is contingent on her selecting the correct picture, it still immediately follows her saying *truck* while looking at the picture of the truck. So we've got:



* And what does ***paying attention*** mean? It means more than Chase's talk-produced sound waves striking Shreeya's ear drums. It also means that she's doing something so that those sound waves from his spoken words are functioning as S^Ds for her responding. I'm afraid we can't be more specific than that. We know that if Shreeya's responding correctly to Chase's instructions, the S^Ds, she's paying attention. However, if she doesn't respond correctly, she might still have been paying attention but just hasn't yet learned the correct response. It's the same with paying attention to the picture comparison stimuli: If she isn't even looking at them, she's not paying attention. But even if her eyes are oriented toward the pictures, and even if she seems to be scanning those pictures, she may not be paying attention. (And it's not just Shreeya: I press the control tab on my MacBook, and that produces a row of icons for programs currently open. Then I scan the row of icons to select the program I want to bring to the top for me to use. But I often have to scan it twice before I start paying attention and actually click on the one I want. Pathetic!)

Eventually when people tell her the name of something, she covertly echoes it, and the Cheeto reinforcer has come to be replaced by a conditioned reinforcer that keeps this learning going on. In other words, the receptive-ID training, combined with Shreeya's echoing, taught Shreeya what we behavior analysts call **naming.**[11]

The result is:

- When the spoken word *truck* is an S^D for selecting a picture of a truck,
- then a picture of a truck is an S^D for saying *truck*,
- without explicit training to establish the picture of the truck as an S^D.

Definition: CONCEPT

Naming

- When one stimulus is an S^D for a response,
- then the stimulus associated with that response is also an S^D for a response to the first stimulus,
- without explicit training to establish that other stimulus as an S^D.

And this definition of naming also applies to receptive ID-ing as well as expressive ID-ing:

- When a picture of a truck is an S^D for saying *truck*,
- then the spoken word *truck* is an S^D for selecting a picture of a truck,
- without explicit training to establish the spoken work *truck* as an S^D.

We may be overstating it a bit with Shreeya, just like we're also overstating it for ourselves. Like you know that everything your professor tells you during the lecture won't end up in your response on the final exam, unless you give yourself a lot of Cheetos while you're practicing it all, on the late night before your final.

The Essence of Naming

We think the essence of **naming** is to automatically learn to **expressively *identify (ID)*** something, as a result of having learned to **receptively** ID it. In other words, you learn to **expressively ID** it without any explicit training to do so. And maybe also automatically learning to **receptively** ID something, as a result of having learned to **expressively** ID it is part of the essence of naming.

Another Example of Receptive to Expressive Identification

Receptive Identification: You're taught to select the picture of Beyoncé, if your teacher says, *Beyoncé*, when her picture is randomly placed among Taylor Swift's and Rihanna's pictures.

Expressive Identification: And then, when someone points at her picture and asks, *Who's that*? You say, *Beyoncé*.

And vice versa.

Another Example of Expressive to Receptive Identification

Expressive Identification: You're taught to say, *Rihanna*, when your teacher points to her picture and asks, *Who's that?*

Receptive Identification: And then, when someone says *Point to Rihanna*, you point to her picture and not Beyoncé's or Taylor's.

In each case, you'd be getting one for free, just like Shreeya did with Chase. And, we might consider it even more sophisticated, ideal, full naming, if a person can just tell Shreeya or you or me, *That's Beyoncé*; and then, she or you or I could tell another person *That's Beyoncé*, because we'd covertly echoed it originally and that echoing had been sufficiently reinforcing, in its own right, that we had learned her name and now could expressively identify her, later on.

QUESTIONS

1. *Naming*—define it, give an example, and explain why it's such a big deal.
2. Describe a procedure used to teach naming.

Follow Up With Shreeya

Shreeya continued at the Gagie School, where she studied traditional grade-school courses and went on extensive class trips, still making progress in many areas. Now at the age of 13, her family has moved to Grand Rapids, where she's getting in-home, behavior-analytic help and has started at a new autism center. Her basic verbal behavior has continued to greatly improve, as have her daily living skills, like cooking (a favorite activity). And at the age of 13, Shreeya still has a ways to go; but when she was evaluated so that her medical insurance could continue to pay for her behavior-analysis services, the insurance company was able to claim that she no longer "had autism" and, therefore, she was no longer eligible for insurance-supported behavior-analysis services. (Of course, the insurance company's claim saved them a few dollars.) Still we're all very happy to see Shreeya's great progress from the little 2 1/2-year-old girl who could only squeal to a teenager who has learned all the verbal operants and even has generative language (generative verbal behavior).

ADVANCED ENRICHMENT*

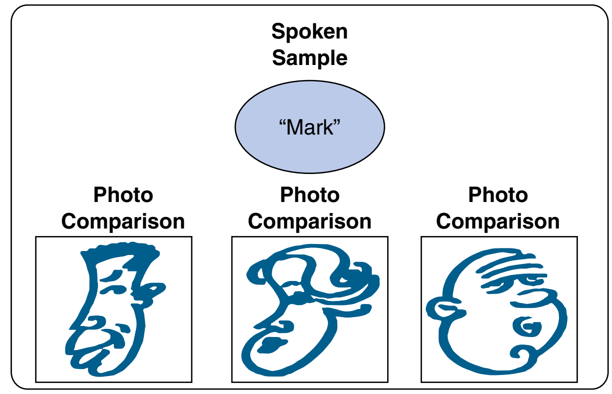
*Stimulus Equivalence—Putting the Names With the Faces*** [12] (G-12)

A few illegal beers, no seat belt, a fast pickup truck, a missed curve, and sudden impact with an unyielding oak tree caused extensive, diffuse brain damage in 19-year-old Al. And now, after 11 years in a traditional brain-injury rehab program, Al still couldn't identify the therapists he saw daily. This is a common outcome of some brain injuries—the inability to do certain kinds of symbolic matching-to-sample, the inability to match spoken and written words (comparison stimuli) to their corresponding objects, people, or events (sample stimuli). However, like many others with such brain injuries, Al could do some other sorts of symbolic matching; he could match the therapists' written names (comparison stimuli) when Dawn spoke their names (sample stimuli), and he could also match (say) their spoken name when Dawn pointed to a written name (sample stimulus); in other words, he could still "read."

After 11 years of traditional therapy, Al still needed to look at a written schedule to determine the name of the therapist he was to work with next—the speech therapist, the occupational therapist, the rehabilitation therapist. His inability to do people–name symbolic matching limited his independence.

Symbolic Matching-to-Sample

Now it was time to implement some behavioral training. Dawn said, "Mark" (sample stimulus), and Al pointed to a color photo of Mark (comparison stimulus on the left). Dawn said, "That's right" (the presumed conditioned reinforcer).



Then she started a new trial by saying, "Bev." But this time Al pointed again to Mark's photo instead of Bev's (comparison photo in the center, in case you couldn't tell), so Dawn said, "Try again." When Al pointed to Bev's photo, Dawn said, "That's right," and went on to the next trial.

For the next month, Dawn and Al did matching-to-sample with Dawn speaking the names of Al's three therapists and Al attempting to point to the appropriate photo. It took them 2,160 trials before Al became essentially perfect at matching the photos to the spoken names. Now that's a lot of trials; however, with this sort of intensive behavioral training, they made more progress in 1 month than the traditional therapists had made in 11 years. Very few traditional professionals seem to appreciate the importance of such intensive training.

Symmetry

But that's not the whole story. Before, Al was trained to point to the photo when Dawn said the name (receptive ID):

A	=	B
(Spoken name)	→	**(Photo)**

Al had also not been able to say the name when Dawn pointed to the photo (expressive ID).

But now, after the training of spoken name to photo, Al could say the name when Dawn pointed to the photo:

B	=	A
(Photo)	→	**(Spoken name)***

* **Warning:** This is definitely the most difficult section in the book. Probably too hard for undergrads and we're not sure about grads. Sorry.

** We added this section because the topic has become so important that we had to include it; and the concepts are so complex that we would be guilty of false advertising if we claimed it was only of intermediate difficulty. However, we've done our best to make it as clear as possible, so if you can find a clearer explanation anywhere else in the known universe, let us know and we'll plagiarize it for our next edition.

* When we talk about matching to sample, either identity matching or symbolic matching, we're talking about matching a comparison

This is **naming**, just like Shreeya's naming of *truck*, etc. And that's a big deal; perhaps it saved Al and Dawn an extra month's intensive training.

You might be tempted to say, "Of course, if Al *knows* this is Mark's photo, then he *knows* that *Mark* is the name of the guy in the photo." But it ain't necessarily so. Not with Polly Pigeon, and not with Shreeya before she'd had her naming training and acquired her naming skills. For example, you could do symbolic matching to sample with either Polly or Shreeya (before she had naming), where they would be given a color green and they would peck or touch the arbitrary symbol, the word *green*.

A	=	B
(Green)	**→**	**(Written "green")**

But given the word *green*, they would not then be able to peck or touch the color green.*

That's the trouble with using commonsense, mentalistic words such as *know*, as in, "Of course, if Al *knows* this is Mark's photo, then he *knows* that 'Mark' is the name of the guy in the photo." Using such commonsense, mentalistic words causes us to get too sloppy in our analysis. Taking it back to the Skinner box, Polly's symbolic matching to sample brings us back to reality, strips us of our hidden assumptions, and helps us tighten it up.

Because of his naming skills, Al has achieved what's called **symmetry**, which means that because Al is trained to pick the photo when he hears the name, he can also say the name when he sees the photo.

stimulus to a sample stimulus, not a comparison response to a sample stimulus. To be more precise, we might say Al is matching the auditory stimuli arising from his saying the name (comparison stimulus) to the auditory stimuli arising from Dawn's saying the name (sample stimulus). And the same will apply even when we will later talk about Al's saying the name covertly; here the comparison stimuli are whatever the stimuli are that arise when Al "hears" himself "speaking" covertly, "talking to himself" covertly. Of course, Al's response of generating the comparison stimulus by actually speaking the auditory name is much more complex than his response of selecting the comparison stimulus by merely pointing to the written name.

* Behavior analysts have done some excellent research on stimulus equivalence and related phenomena with nonverbal animals; however, their procedures differed sufficiently from the ones we're considering that we'll stick to our guns (at least for now) in saying that nonverbal organisms wouldn't achieve symmetry and the other results we'll be talking about with the procedures we're describing.

	A	=	B
Training:	**(Spoken name)**	**→**	**(Photo)**
	B	**=**	**A**
Results:	**(Photo)**	**→**	**(Spoken name)**

In other words, the stimulus control exerted by the name and the photo is *symmetrical*—it works either way. By *symmetry* we mean that if A = B, then B = A (e.g., if 1 + 2 = 3; then 3 = 1 + 2), as you remember from your first algebra course. This is the naming repertoire that Shreeya had acquired through stimulus-equivalence training; but with Shreeya, it was even cooler because her naming repertoire allowed her to achieve symmetry even if she'd only been taught in one direction, even if she was only taught A = B, she'd also have B = A.

Definition: CONCEPT**

Symmetry (symmetrical stimulus control)

- When a stimulus is an S^D for one response,
- then the stimulus associated with that response
- will be an S^D for the response associated with the first stimulus.

Symmetry

These definitions aren't easy. And we think part of the problem is understanding what we mean by *stimulus associated with that response*. We mean *the sight of the written name* is the stimulus associated with the response of *writing that name*.

Theory

So how did brain-injured Al do this, when neither Polly nor pre-naming Shreeya could achieve symmetry with symbolic matching to sample? We don't know for sure, but here's our theory: Dawn said, "Mark"; and Al said, "Mark," also—

A	=	A
(Spoken "Mark")	**→**	**(Spoken "Mark")**

though perhaps covertly, under his breath, when he touched Mark's photo. Just like we think Shreeya was doing.

** Sofia Peters pointed out that our definitions of *naming* and *symmetry* are essentially the same. I think she's got a good point, and I'll stick with that, at least for now.

B	=	A
(Mark's photo)	→	**(Covertly spoken "Mark")**

And then Dawn said, "That's right," reinforcing both Al's touching Mark's photo and his covertly saying, "Mark." So when Dawn pointed to Mark's photo and asked, "Who's this?" it was easy for Al to increase the intensity of the covert, under-his-breath "Mark" to an out-loud "Mark," a response that had been reinforced throughout the preceding 2,160 training trials.

B	=	A
(Mark's photo)	→	**(Overtly spoken "Mark")**

But neither Polly nor pre-naming Shreeya could say, "green," so they were out of luck when it came to their test of symmetrical stimulus control.

Transitivity

And there's a more amazing result than the symmetrical stimulus control. Remember that even before training, Al could match the written names to Dawn's spoken names.

A	=	C
(Spoken name)	→	**(Written name)**

And after 2,160 trials, he could match the photos to names Dawn spoke;

A	=	B
(Spoken name)	→	**(Photo)**

and, because of symmetrical stimulus control, he could also say the name when Dawn pointed to a photo.

B	=	A
(Photo)	→	**(Spoken name)**

Now here it comes: After those 2,160 training trials, it turns out Al could also match the written names to the photos; in other words, when Dawn touched Mark's photo, Al would touch Mark's written name.

B	=	C
(Photo)	→	**(Written name)**

And he would do this even though he'd never had symbolic matching-to-sample training involving both the photos and the written names in the same procedure. This also is novel stimulus control; by *novel stimulus control* we mean a "correct" response to a stimulus when that response to that stimulus had not been reinforced previously; in this case, neither the stimulus nor the response was novel, but this response to that stimulus was novel; so we've got novel stimulus control. And that is another feature of **generative language**.

So Al also has achieved what's called ***transitivity***, which means that because Al is trained to pick the photo when he hears the name and because he can also pick the written name when he hears the name,* now he can pick the written name when he sees the photo and vice versa. In other words, the stimulus control exerted by the written name and the photo has a *transitive* relationship. By *transitivity* we mean, for example, if A = B and A = C, then B = C, and also C = B. High-school algebra.

That's cool, but the *definition* of **transitivity** is more difficult to understand than an *example* of **transitivity**; even Kelly and I have trouble understanding our own definition!

Definition: CONCEPT

Transitivity

- When one stimulus is the S^D for two different responses,
- then the stimulus associated with one of those two responses
- will be an S^D for the other of those two responses.**

Yeah, tough. So let's fill in the definition, with our example.

* No doubt picking the written name when he heard the spoken name was a result of training Al must have had before Dawn started working with him.

** We've changed this definition of transitivity from one in an earlier draft. Before, we had said
- When one stimulus is the SD for two different responses,
- then the stimulus associated with each of those two responses
- will be SDs for the other of those two responses.

But, on second thought, let's call that bi-directional transitivity. And we'll still call it transitivity if only
- the stimulus associated with one of those two responses
- will be SD for the other one of those two responses

Let's call this one fundamental transitivity.

Transitivity Example

- When one stimulus (*spoken name*) is the S^D for two different responses (*writing the name and also selecting the photo*),
- then the **stimulus associated with each one of those two responses** (*the written name or the photo*)
- will be an S^D for the other of those two responses (*selecting the photo or writing the name*).

Now read the boxed definition again, and then this "Transitivity Example" again. Then check out the next diagram, the triangular diagram (page 443). Etc. You have our thoughts and prayers, but that's the best we can do.

	A	=	C
Training:	**(Spoken name)**	**write**	**(Written name)**
	A	**=**	**B**
Training:	**(Spoken name)**	**select**	**(Photo)**
	B	**=**	**C**
Results:	**(Photo)**	**write**	**(Written name)**

Theory

How? More speculative theory: When Al sees Mark's photo, he says, "Mark," either overtly or covertly, as he'd learned from the training.

B	=	A
(Photo)	→	**(Spoken name)**

And he was already able to match the written names to Dawn's spoken names.

A	=	C
(Dawn speaks name)	→	**(Written name)**

So now he just matches the written names to his own speaking of the names.

A	=	C
(Al speaks name)	→	**(Written name)**

And we've got a *behavioral chain*: Al sees Mark's photo, he then says "Mark," he hears the sound of the word he just spoke, and that sound acts as an S^D for his touching the written name "Mark" even though the photo is no longer present.

S^D (Photo) → Response (Al speaks name) → S^D (Sound of name) → Response (Al touches written name)

Al touches the correct written name when Dawn points to one of the therapists' photos, even though he was never explicitly trained to do so.

Reflexivity

Just for the record, there's one more term that goes with *symmetry* and *transitivity*; that's *reflexivity*.

Reflexivity refers to the results of simple non-symbolic matching to sample, like Polly's matching red with red. Similarly, even before Dawn's training, Al could match written words with identical written words, and photos with identical photos. In other words, his behavior was already under reflexive stimulus control. By reflexivity, we mean A = A—again, from your first algebra course. Yes, boys and girls, all those years of rigorous math training are finally paying off!

Definition: CONCEPT

Reflexivity

- The matching of two identical stimuli;
- A = A.

Practical Implications

If Al's behavior could not come under symmetrical and transitive stimulus control, it might have taken him many months, instead of just one, to master the various combinations of matching between the spoken names, the written names, and the photos. And the time saving gets even greater, for example, when you're teaching reading, using a larger set of words and stimuli.

There was another practical result of the present intervention: Al's training with Dawn transferred to his daily life at the rehab center. He could now name the therapists themselves, not just their pictures. This meant, for example, that when he wanted to talk to his physical therapist, he could find her and identify her—a nice step in the right direction.*

Stimulus Equivalence

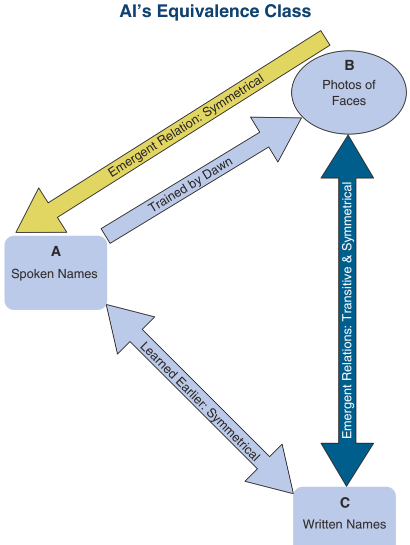
Most behavior analysts say a set of arbitrary, symbolic stimuli has formed an ***equivalence class*** if all stimuli in that set have reflexive, symmetrical, and transitive relations (e.g., Mark's written and spoken name and his photo). Equivalence classes result from **stimulus-equivalence training**, the sort of symbolic matching to sample Al did. Stimulus-equivalence training is especially useful because you don't have to do symbolic-matching training with all combinations of the stimuli to produce an equivalence class, but instead some of the reflexive, symmetrical, and transitive stimulus-control relations emerge when just a few of the combinations are explicitly trained, as was the case with Al. Those stimulus-control relations that emerge without being explicitly trained are called ***emergent relations***.

Definition: CONCEPT

Stimulus-equivalence training

- The training of stimuli using symbolic match to sample
- that produces stimulus equivalence.

Al's Equivalence Class



* It is beyond our purpose and available space to go into the more complex, though perhaps more practical, applications of stimulus-equivalence training, but they exist: In regular preschool education, researchers have used stimulus equivalence to teach reading, writing, and arithmetic.

Equivalence Class vs. Stimulus Class

A **stimulus class (concept)** is a set of stimuli that have some common physical property. (For example, red apples form a concept that has such common physical properties such as color, size, shape, and taste, though no two red apples are identical.) But an ***equivalence class*** is a set of arbitrary symbolic stimuli that need not have common physical properties. (For example, the spoken and written stimuli "Mark" share no common physical properties with the photo of Mark; instead, they are arbitrary, symbolic stimuli.) An equivalence class is an arbitrary class, a class that is formed only as a result of symbolic, matching-to-sample, stimulus-equivalence training. Now philosophers may come down on us for this, but a stimulus class is inherently a class, regardless of whether we do concept training. The only reason we do concept training is to get our behavior under the control of the already preexisting concept. We say we have **stimulus equivalence** when we've created an **equivalence class**, and that results from **equivalence training**. Heavy.

Definition: CONCEPT

Stimulus equivalence

- Stimuli are equivalent, when they have
- symmetrical,
- transitive, and
- reflexive relations
- but do not have common physical properties.

Warning: There's an unresolved debate in the field of behavior analysis concerning whether these emergent relations are basic behavioral concepts that can be used to explain generative language (linguistic productivity) or whether verbal behavior (language) along with basic behavioral concepts can be used to explain emergent ***relations***. We've taken the latter position: We use Shreeya and Al's echoing the trainer's spoken word during their receptive training (stimulus equivalence training) to explain their acquiring derived relations, including naming. But the debate rages on and on.

Derived Stimulus Relations

Those stimulus-control relations that *emerge* without being explicitly trained are called ***emergent relations*** or **derived stimulus relations**.

Definition: CONCEPT

Derived stimulus relation

- The relation between two or more stimuli
- is derived from independent training with those stimuli
- and other stimuli with which they have a relation.

For example, *the relation between* Mark's photo and spoken "Mark" was trained. And so was the relation between written "Mark" and spoken "Mark." And as a result of that *independent training with those stimuli*, the relation between Mark's photo and written "Mark" was *derived*—a **derived stimulus relation**!

By the way, if you're still having trouble with this, put your finger on the relevant parts of the previous diagram as you reread the previous paragraph. At least it helped me understand what I'd just written!

Also, we've just talked about derived equivalence relations, but the derived relations need not be equivalent. For example, if I tell you, "Mark is taller than Dick" and "Dick is taller than Kelly," I'll bet your behavioral history is so elaborate that you can derive the stimulus relation, "Mark is taller than Kelly." Would we call that a *taller than* class?

QUESTIONS

1. Use an example to illustrate the difference between symmetry, transitivity, and reflexivity.
2. Describe an intervention using stimulus-equivalence training to help a brain-injured man be able to match faces to written and spoken names and vice versa.
   a. What was the equivalence class in this intervention?
   b. What were the emergent relations in this intervention?
   c. What were the transitive relations?
   d. What was an emergent symmetrical relation?
   e. Just for the record, what was one of the reflexive relations?
   f. What were the two practical results of this stimulus-equivalence training?
3. Define and provide examples of:
   a. Symmetry (symmetrical stimulus control)
   b. Transitivity
   c. Reflexivity
   d. Stimulus-equivalence training
   e. Stimulus equivalence
   f. Derived stimulus relation

Notes

1 Skinner, B. F. (1957, 1992). *Verbal behavior*. Acton, MA: Copley Publishing Group and the B. F. Skinner Foundation (Original work published in 1957).

2 Skinner, B. F. (1957). *Verbal behavior*. New York: Appleton-Century-Crofts.

3 And by the way, newborn infants pay attention to sounds similar to their mothers' voices and not to other voices, suggesting that the sound of mother's voice became a conditioned reinforcer while the baby was still in the mother's womb. Decasper, A. J., & Spence, M. J. (1987). Prenatal maternal speech influences on newborn's perception of speech sounds. *Infant Behavior and Development*, *2*, 133–150.

4 Based on Shane, J. (2016). *Increasing vocal behavior and establishing echoic stimulus control in children with autism* (Unpublished doctoral dissertation). Western Michigan University, Kalamazoo, MI.

5 Based on Tomak, M. L. (2020). *Teaching children with autism to make independent requests using an echoic-to-mand procedure* (Unpublished dissertation). Western Michigan University, Kalamazoo, MI, which was, in turn, based on Greer, R. D., & Ross, D. E. (2008). *Verbal behavior analysis: Inducing and expanding new verbal capabilities in children with language delays*. Boston: Pearson, Allyn & Bacon.

6 By the way, when starting to teach mands, don't start with generalized mands, a common error is to start mand training by teaching a generalized mand (like *more*, *help*, or *please*); instead teach specific ones, like *candy*, *play*, *car*. For info on this, check out www.mcginnisdeanpress.com/blog/2016/2/12/the-benefits-of-teaching-mands-specific-to-the-motivation

7 Based on (now Kohler) Stone, K. (2009). *Fading from stimulus matching to listener discrimination* (Unpublished Master's Project). Western Michigan University, Kalamazoo, MI.

8 Retrieved from www.headsprout.com

9 Kohler, K. T., & Malott, R. W. (2014). Matrix training and verbal generativity in children with autism. *Analysis of Verbal Behavior*, *30*, 170–177.

10 Skinner, B. F. (1957). *Verbal behavior*. New York: Appleton-Century-Crofts.

11 Inspired by Callard, C., *Teaching naming to children with autism* (MA Project). Western Michigan University, Kalamazoo, MI; but we've taken the liberty of trimming it down a bit to make the points we've been going for.

12 Based on Cowley, B. J., Green, G., & Braunling-McMorrow, D. (1992). Using stimulus equivalence procedures to teach name–face matching to adults with brain injuries. *Journal of Applied Behavior Analysis, 25,* 461–475. This was Brian Cowley's master's thesis in behavior analysis and therapy at Southern Illinois University at Carbondale, a major center for behavior analysis. Incidentally, Gina Green is one of the most prominent researcher/practitioners in the field of autism and was the president of ABA.

PART XIV

Rule-Governed Behavior

CHAPTER 25

Rule-Governed Behavior: Concepts and Applications

Behavior Analyst Certification Board 5th Edition Task List Items

B-13.	Define and provide examples of rule-governed and contingency-shaped behavior.	Throughout
G-6.	Use of instructions and rules.	Throughout
G-19.	Use contingency contracting.	Pages 446–447
I-5.	Use performance monitoring, feedback, and reinforcement systems.	Pages 458–459

Example

BEHAVIORAL MEDICINE

Bubblegum and Bowel Movements—Part II[1] *(B-13)*

Remember Todd? He's the bubblegum kid from Chapter 6. Todd had been having trouble with bowel movements. His mother had reinforced his bowel movements by giving him a piece of bubblegum immediately after each bowel movement.

Direct-Acting Contingency

Before	Behavior	After
Todd has no bubblegum.	Todd has a bowel movement.	Todd has bubblegum.

But, as Sid pointed out, that reinforcement procedure would be awkward to maintain forever.

So after her early success with Todd using immediate presentation of bubblegum to reinforce his bowel movements, Dawn thought it was time to make the bowel-movement intervention more practical. Therefore, she asked Todd's mother to tell him they would use a new rule. He could still have bubblegum from time to time, no longer contingent on the bowel movement, but now, if he had a bowel movement any time before dinner, he could have dessert after dinner. It worked. Two years later, Todd was having bowel movements six times per week—not bad for a kid who had been having a bowel movement only once a week.

Analysis

Once again, let's look at our definition of ***reinforcement by the presentation of reinforcers***—*a response becomes more frequent in the future if a reinforcer or an increase in a reinforcer has followed it in the past*. Now let's apply that definition to Dawn's final intervention with Todd:

- First, what was the response? The bowel movement (contraction of the colon and the relaxation of the sphincter muscle).
- Was that set of responses more likely to occur? Yes, it was more likely to occur than before Dawn started her first intervention.
- The reinforcer? The dessert. Was it really a reinforcer? It was at least enough of a reinforcer to reinforce Todd's eating it. So that gives us hope that it might be enough of a reinforcer to support the bowel movements.
- Finally, did the reinforcer follow the bowel movement within 60 seconds? No! Todd's bowel movements had to occur before dinner; for instance, he might have had a bowel movement in the morning, but he still wouldn't get the reinforcer until after dinner.

Our First Approximation

Before	Behavior	Delay	After
Todd has no dessert.	Todd has a bowel movement.	A few hours later	Todd has a dessert.

That's the problem: The reinforcer did not follow within 60 seconds of the response. The delay between the bowel movement and the dessert was too great for the dessert to reinforce the bowel movement. Yet the bowel movements maintained.

The reinforcer must follow the response within 60 seconds to reinforce that response.*

Seems strange. When you think about it, this whole reinforcement business seems fishy. In about 2 minutes, you can think of a half dozen other exceptions, cases where the reinforcer occurred a long time after the response, and yet the reinforcer seemed involved in causing the response. Go ahead; give it a shot. Close your eyes for 2 minutes and see how many exceptions you can think of, cases of the delayed delivery of reinforcers—for instance, like enrolling in college and getting a college degree years later.

Are the 2 minutes up yet? Remember, don't open your eyes until the time's up. So how many did you get? Like buying groceries this morning, so you'll have something for dinner tonight. Like getting tickets in advance, so you'll get seats at the concert of Bobby Behavior and the Behaviorettes. Like setting your alarm the night before. Like almost everything you do in your life.**

If the dessert intervention wasn't reinforcement, what was it? ***Rule control***. The **rule** was: *If you have a bowel movement today, you can get a dessert after dinner*. Here's why we think the dessert intervention was rule control: Suppose Todd's mother had given him a dinner dessert every day he had had a bowel movement. But suppose she had failed to tell him about the relation between his bowel movements and the desserts; in other words, suppose she had failed to tell him the rule. Would those dinner desserts have reinforced and thereby maintained the regular occurrence of his bowel movements? No, the desserts were too delayed. Todd needed the rule describing the contingency, if his bowel movements were to maintain. The rule controlled the bowel movements. (Of course, the rule would have lost its control if it had proven false and his mother hadn't given Todd his just desserts.)

Here are some relevant, new concepts (semi-new, we hit on them briefly in Chapter 3). But first recall an old, familiar friend: **behavioral contingency**—*the occasion for a response (S^D), the response, and the outcome of the response*.

Definition: CONCEPTS

Rule

- A description of a behavioral contingency.

Rule-governed behavior

- Behavior under the control of a rule.

Contingency-shaped behavior

- Behavior under the control of a direct-acting contingency.

The rule describing the dessert contingency specified the S^D (any time before dinner), the response (a bowel movement), and the outcome (dinner dessert). The rule did control the behavior, so the bowel movement was **rule-governed behavior**. Because Todd needed the rule, the bowel movement was not **contingency-shaped behavior**, during this second intervention. And while we're at it, recall another behavior-analytic term, *contingency contract*.

A ***contingency contract*** is usually a rule a performance manager, for example, Todd's mama, gives to the person whose performance is being managed, for example, Todd: *If you have a bowel movement today, you can get a dessert after dinner*. Of course, if Todd were hyper-cool, he might tell Mama what the rule is that he wants her to use to manage his behavior, but that rarely happens. This is an example of contingency contracting.

* And remember our little 60″ rule is just a rough approximation: a reinforcer a little sooner than 60″ might be too delayed to reinforce the response, and a reinforcer delayed a little longer than 60″ still might reinforce that response. But 60″ is easy for us all to remember.

** In these informal examples, we don't suggest that a future outcome can cause a current event. We don't suggest that something that hasn't even happened yet can cause something that is happening now. Having seats at a concert that hasn't occurred can't cause your reserving seats now. With unreliable rock stars like Bobby Behavior, the concert might be canceled. So you would have reserved your seats, even though there turned out to be no concert for which you would use those seats. The concert was a nothing, but your behavior of reserving the seats earlier was a something. And a nothing can't cause a something. To be logical and safe, we need to make sure the cause has occurred before the effect (the result). Otherwise, we're making the error of *teleology*—the doctrine that the future can influence the present.

QUESTION

1. For each of the following concepts: define it and give an example.
   a. *rule*
   b. *rule-governed behavior*
   c. *contingency-shaped behavior*

WHEN REINFORCEMENT WON'T WORK: THE PROBLEM OF REINFORCEMENT VS. THE DELAYED DELIVERY OF A REINFORCER

As we said in Chapter 3, the data indicate that a reinforcer must follow a response within 60 seconds for it to reinforce that response. But this is such a big deal we'd like to say it a hundred more times. Why? Because even professionals mess up this one. They're apt to say something like, "Jones campaigned actively and got elected president. So her being elected must have reinforced her campaigning." What's wrong with this statement? The officials announced the election results too long after her election campaigning, especially the earlier part that she started months before the election. If the reinforcer follows the response by more than a few seconds, it will not reinforce that response. The election results followed the campaigning activities by more than a few seconds. So the election results couldn't have reinforced her campaigning. So any increased frequency of Jones's campaigning in future elections will not have resulted from the direct reinforcement of her winning the election.

True, often the delayed delivery of reinforcers does influence or control our actions. Todd's dinner desserts show this. So do compliments: You put on a brand-new sweater in the morning; in the afternoon several friends compliment you on it. Not a bad reinforcer, but too delayed to reinforce putting on the sweater. In other words, you'll put on the sweater more frequently, but not because the compliments reinforced that action. Something else is going on.

Rather than the delayed reinforcers themselves, statements about the possibility of those delayed reinforcers are what more directly influence or control our actions. The promise of reinforcers can control our actions, even before our receipt of those delayed reinforcers: "When you go for your job interview today, remember, smile, look the interviewer in the eye, and wipe the sweat off your palms before you shake hands. Follow my advice and within a few days, you'll be getting a job offer from the main office."

These cases of delayed reinforcers and promises of delayed reinforcers involve more than the simple procedures of reinforcement. We're talking about rule control. The behavior occurs not just because of the contingency but because someone has stated the rule. The person who states the rule might be the person doing the behaving, or it might be someone who has stated the rule to that person.

QUESTION

1. Give an example where behavior is controlled by the promise of the reinforcer rather than the delivery of that reinforcer.

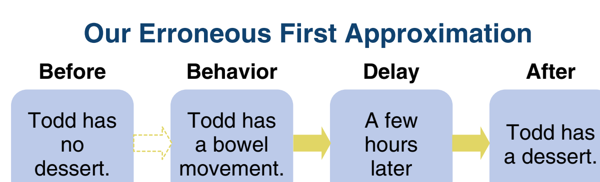
THE DEADLINE

OK, that was the easy part of this chapter. Now we take off the training wheels. It took me 21 years between the 1st and 2nd editions of this book to realize there was a problem with our analysis of some of the studies: We analyzed them as if they involved simple Skinner box-type contingencies, when they really involved delayed outcomes that required rule control. And it took me another 10 years (between the 2nd and the 5th editions) to discover and address an equally complex problem.

Originally, I had thought the delayed-outcome contingencies were indirect-acting analogs to reinforcement contingencies. But now I realize life is more complex. Most of these indirect-acting contingencies involve deadlines, a fact we hadn't noticed when we wrote the 2nd edition.

Todd's Dessert Contingency

When we analyzed Todd's dessert contingency, we left out a crucial component—the deadline.



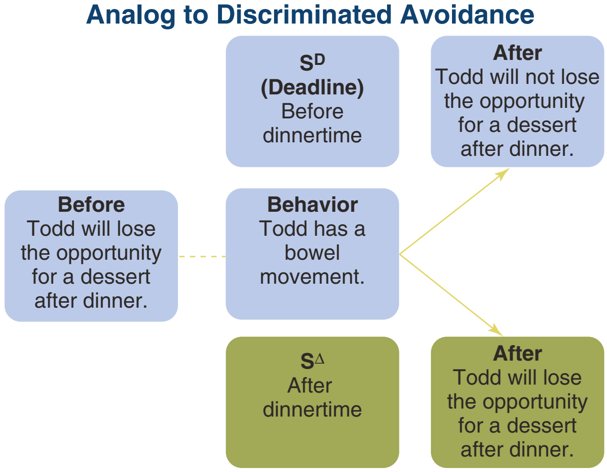
Todd couldn't have his bowel movement whenever he wanted, if he were to get his dessert; he had to make that crucial response before dinnertime. He couldn't dawdle and procrastinate forever; mealtime was the deadline for his bowel movement. But I still wasn't out of the woods. It took me another few years to figure out what the function of the deadline is. The deadline demarks when the S^D period ends.

So the time before the mealtime deadline is the S^D; it's the only time Todd's bowel movement will pay off with a dessert. And the time after the deadline, the S^Δ, is when a bowel movement won't pay off with a dessert.

And still, we were not quite out of the woods. I was shocked to realize that putting a deadline into the contingency changes it from an analog of a discriminated reinforcement contingency to an analog of a discriminated avoidance contingency. In other words, if Todd doesn't have his bowel movement before dinnertime, he will lose the opportunity to get the dessert.

So now the latest, most complex version of Todd's contingency:*

Our Final Word:
Analog to Discriminated Avoidance



> * Note: We sometimes incorporate the delay in the before and after conditions thereby eliminating the need for the delay box of previous editions.

QUESTION

1. Give an example where an apparent delayed analog to reinforcement is really a delayed analog to discriminated avoidance.
   a. Include a discussion of the role of the deadline.
   b. Be able to diagram your example.

* So, as of *PoB* 6e, our official position has been that adding deadlines converts contingencies to avoidance contingencies. Therefore, the time before the deadline is either an S^D (a discriminated avoidance contingency) or merely the time when there's an opportunity to respond (a nondiscriminated avoidance contingency).

SOME IMPORTANT DISTINCTIONS

We've casually used the terms **direct-acting** and **indirect-acting contingencies**; now let's get formal.

Definition: CONCEPT

Direct-acting contingency

- A contingency in which
- the outcome of the response
- reinforces or punishes that response.

Here are some contingencies that are probably direct acting: The rat presses the bar and immediately gets a drop of water. You turn the handle of the drinking fountain and immediately get water. The pigeon pecks the key and immediately gets 3 seconds' access to food. You put a coin in the candy machine and immediately get a candy bar. You tell a joke and everyone immediately groans. And so on—you know the story by now; these contingencies are what you've been studying throughout this course—direct-acting contingencies, contingencies with outcomes that follow the response by less than 60 seconds, usually much less. On the other hand, indirect-acting contingencies have outcomes that follow the response by more than 60 seconds, often much more.

Definition: CONCEPT

Indirect-acting contingency

- A contingency that controls the response,
- though the outcome of the response
- does **not** reinforce or punish that response.

If a contingency is indirect acting, what is controlling the behavior more directly? The statement of a rule describing that contingency. Wherever you have an effective indirect-acting contingency, you have rule-governed behavior.

Here are some contingencies that, if they control your behavior, are probably indirect acting: If you apply to college before the deadline, you will avoid the loss of the opportunity to enter college *3 months later* (at least if all goes well). If you file your income-tax return and pay your taxes by April 15, you will avoid having to pay a penalty *2 months* later. If you study for your exam tonight, you will avoid really blowing it *tomorrow* (at least if all goes well). In all cases, the response may have caused the outcome (the outcome may be contingent on the response). But in all cases, the outcome was too delayed to reinforce the response that produced it. So if the contingencies do control future behavior, they must do so indirectly, not through direct reinforcement of the causal response but rather through rules describing those contingencies.

By the way, though a contingency may be indirect acting, it would not be correct to say *the response is indirectly reinforced*. If behavior occurs, it's because it's reinforced and reinforced directly. There's no such thing as "indirect reinforcement." (Later, we suggest some possible reinforcement contingencies that reinforce the behavior in indirect-acting contingencies.)

Definition: CONCEPT

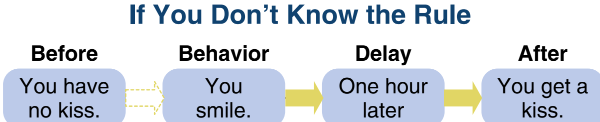
Ineffective contingency

- A contingency that does not control behavior.

Here are some contingencies that are probably ineffective, at least much of the time: The rat presses the bar and an hour later gets a drop of water. Every time you smile, an hour later someone you love gives you a kiss, without telling you why.

You have mild lactose intolerance, so you become mildly ill the day after drinking a glass of milk. Many people have suffered this problem all their lives without knowing why and without the contingency controlling their behavior. We're sure the water will be ineffective for the rat. And we'd wager a modest sum that the smile–kiss and milk–illness contingencies would be ineffective for human beings if they can't state the rule describing the contingencies.

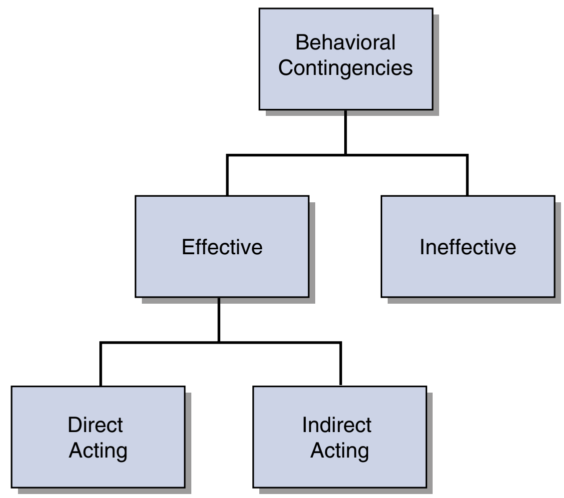
Ineffective Contingency
If You Don't Know the Rule



Note: Two kinds of contingencies are not direct acting. One kind is indirect-acting and, therefore, effective; the other is not effective. If the response produces a food reinforcer within 60 seconds, the contingency is probably direct acting. If the response produces a delayed food reinforcer, *the contingency is not direct acting*. For the pigeon pecking the key, the contingency with the delay will be ineffective. For your putting a turkey in the microwave, the contingency probably will be effective (if you're not a vegetarian); but it will be indirect acting, because even with the world's fastest microwave, the delay of the thawed-turkey reinforcer will be too great to reinforce your putting the turkey in the microwave.

So, we have three types of behavioral contingencies: direct acting, indirect acting, and ineffective.

Contingency Tree



QUESTIONS

1. Define and give an example of each of the following concepts:
   a. *direct-acting contingency*
   b. *indirect-acting contingency*
   c. *ineffective contingency*
2. Construct the contingency tree.

Concept

THE RULE-GOVERNED ANALOG TO DIRECT-ACTING BEHAVIORAL CONTINGENCIES

Throughout this book, we have discussed several basic behavioral procedures, procedures that involve direct-acting contingencies—for example, the procedure of reinforcement by the presentation of reinforcers. But those procedures also have analogs that involve contingencies that are not direct acting. In other words, because the outcome is too delayed, such contingencies will not reinforce or punish a response.

By the way, here's what we mean by ***analog***: Two procedures are analogous when they are alike in some ways and not in other important ways. For example, suppose a response occurs; then immediately afterward, a reinforcer follows, and that response increases in frequency as a result; that's reinforcement.

Now here's an analog; it's like reinforcement in some ways but not in others: A response occurs, and 1 day later a reinforcer follows; and that response increases in frequency as a result. That's not reinforcement, even though the response increased in frequency. Both the procedure and the results of this analog look much like reinforcement, but not quite—the 1-day delay between the response and the reinforcer is too great for this to be reinforcement. Something else must be going on.

True, a contingency that is not direct acting can't reinforce a response; yet a rule describing such a contingency might control the relevant response, especially if it's an analog to discriminated avoidance, like Todd's dessert contingency.

It is no accident that, in both cases, the contingency managers gave the clients rules describing the contingencies (e.g., *if you have a bowel movement before dinner, you can have dessert after dinner*). Without the descriptive rules, the contingencies would have failed to control the clients' behaviors. These contingencies look like direct-acting contingencies, but they're not; we call them **rule-governed analogs**.

Definition: CONCEPT

Rule-governed analog

- A change in the frequency of a response
- because of a rule describing the contingency.

Much of research in applied behavior analysis uses procedures based on rule-governed analogs to direct-acting contingencies rather than procedures based on the direct-acting contingencies themselves. This is almost always the case when dealing with people who have reasonable language skills. Furthermore, the researchers are often using rule-governed analogs, although they may describe their research as if they were using direct-acting contingencies.

However, even when the rule is what controls the behavior, the analog contingency might influence the extent to which the rule controls the behavior. For example, suppose a classmate whispered the following rule in your ear: "All you have to do to get a good grade on the quizzes is to memorize the section headings for each chapter." And suppose, in spite of your better judgment, you follow that rule; all you do is memorize the headings. Sure enough, you get an *A* on the test. Then there's a good chance you'll follow that rule for the next test as well. But suppose, instead, when you follow that rule, you end up tying the whisperer for the lowest grade in the class. You probably won't follow that rule again.

The study/grade contingency is only an analog to a reinforcement contingency. The grades are too delayed to reinforce your studying. So the contingency is only indirect acting (needs rule support), not direct acting (directly reinforcing). But, as we've just seen, a delayed contingency can control your behavior by influencing the control the rule exerts over your actions. When an outcome confirms or contradicts a rule, it increases or decreases the frequency with which we'll follow that rule.

QUESTIONS

1. *Rule-governed analog*—state it, give an example, and explain how your example fits the definition.
2. Give an example showing how such an analog can indirectly control behavior.

APPLIED BEHAVIOR ANALYSIS WITH VERBAL AND NONVERBAL CLIENTS

Many of the applications dealing with direct-acting contingencies have involved human beings who have had such difficulty learning functional behavior they've been labeled *intellectually* or *developmentally disabled*, whereas many of those dealing with analog contingencies will involve human beings who have acquired more functional repertoires. This is because, in these applications, many of those with intellectual disabilities did not have the language skills needed for their behavior to come under the control of rules. However, many people do have those language skills; and when possible, it's usually easier to give a rule than to set up and maintain a direct-acting contingency without the help of rules. Of course, some people with intellectual disabilities do have language skills, some even have considerable language. And for those individuals, rule-governed behavior may be fairly common.

RULES, INSTRUCTIONS, REQUESTS, AND INCOMPLETE RULES

Recall our definition of *rule*: a description of a behavioral contingency (the occasion, the response, and the outcome). Here's an example: If every day you study an hour or two for this course, probably you'll ace it. What's the occasion? Every day. The response? Spending an hour or two studying for this course. The likely outcome? Getting that *A*.

Now technically speaking, a rule is a factual description of a contingency. The giver of the pure rule says, in essence, "I don't give a darn whether you ever study and whether you fail the course. I'm just telling you the contingency. Just the facts, ma'am."

What about this one? *Every day, you should study an hour or two for this course so you'll ace it*. That's a rule plus. It's a rule plus the instruction that you should follow the rule (a mand). All instructions seem to involve rules.

And this? *I'd appreciate it if every day you'd study an hour or two for this course so you can get an* A. This is a rule plus a request that you follow the rule (a mand, a gentle instruction).

Often a rule plus is also a rule minus—a rule minus one or two of the components. *Study behavior analysis a couple of hours every day*. We have the occasion and the response but not the outcome. We imply the outcome—that you'll do well.

And *be quiet!* The minimal rule—just the response. Here we imply the occasion (right now!) and the outcome (or you're really gonna get it!). We call these ***incomplete rules***. Sometimes incomplete rules cause no special problem; their context makes them clear, and they control behavior much as the complete version would. But at other times, in elementary-school classrooms, for example, stating the full rule in addition to backing it up works better.

QUESTIONS

1. Give an example of a statement of a rule, a related instructional statement, and a related statement of a request.
2. Give an example of a complete rule and an incomplete rule.

RULES DESCRIBING DIRECT-ACTING CONTINGENCIES

What happens when a person can state the rule describing a direct-acting contingency? We can't be sure. It's hard to know whether the contingency, the rule, or both control the behavior. Consider Todd's bubblegum contingency (the one Dawn used before she started the dessert contingency). Todd's mother did tell him the rule: "Any time (occasion) you have a bowel movement (response), you will immediately get a piece of bubblegum (outcome)." And whenever he asked for an unearned bubblegum, she reminded him of the rule. But he might not have needed the rule. Probably the receipt of the bubblegum within 60 seconds of the response would have reinforced and maintained the bowel movements without the rule. We don't know for sure.

But suppose Todd had rushed into the bathroom and had a bowel movement right after his mother first told him the bubblegum rule. What then? It doesn't seem likely he would have felt such an exceptionally forceful call from nature just at that moment. So we can be fairly sure the rule was governing his behavior.

QUESTIONS

1. Using the bubblegum contingency, give an example of the difficulty of interpreting the effects of rules describing direct-acting contingencies. Show how it's hard to tell whether the rule or the direct-acting contingency or both are controlling behavior. And explain the problem.
2. Using the bubblegum contingency, give an example where we might be able to infer control by a rule describing that contingency—a direct-acting contingency. Explain why.
3. To do well on the quizzes, you may have to keep in mind that rules can describe direct-acting contingencies as well as indirect-acting contingencies. This is easy to forget because we are mainly concerned with rules describing indirect-acting contingencies.

HARD SELL FOR THE SKEPTICAL

Show us someone who's studied behavior analysis for more than 5 minutes before picking up this book, and we'll show you someone who's skeptical of our challenges to the simplistic (e.g., overly simplified) use of the principle of reinforcement, someone who wonders about all this newfangled rule-governed behavior stuff. We mainly address this section to such readers. (On the other hand, most readers who are getting the word for the first time are probably relieved to know there may be more to life than the simple principle of reinforcement.)

OK, the difference between contingency-shaped behavior and rule-governed behavior is the difference between your pet dog and your little brother. Try this experiment. For your dog, select some response that has a low operant level, a response it makes about once a week. (Remember, the *operant level* is the rate of responding before intervention.) Do the same for your brother. Like maybe when Fido (the dog, not the brother, right?) brings you your slippers; that may have a low operant level. And like when little brother says, "Thank you" and at an appropriate time—a low operant level. Each time the dog brings the slippers, give it one of its favorite dog biscuits—but not right away; give the biscuit to Fido the next day. Do the same with little brother for his "thank you," except in the interest of his health, don't use dog biscuits or the human equivalent; instead use the junk food of today's youth—video games. Each time he says "thank you," allow him to play your Xbox for 5 extra minutes the next day. Experiment for a year, carefully recording the frequency of the two responses. Mail us your results. We predict the frequency of slipper carrying and "thank you" will not increase. We also predict that you wouldn't want to bet otherwise. A 1-day delay is too great for reinforcement to occur. These particular dog-biscuit and video game contingencies are **ineffective contingencies**—they don't control behavior.

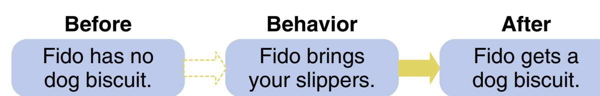
We said the difference between **contingency-shaped behavior** and **rule-governed behavior** is the difference between your dog and your little brother. But, instead, they're giving us the same results. That scientifically proves there's a bit of the dog in your brother.

So let's go to the final phase of the experiment. Tell your little brother the rule; tell him every meaningful "thank you" will produce the opportunity to play your Xbox for 5 extra minutes, the next day. If you insist, you can tell Fido his rule also.

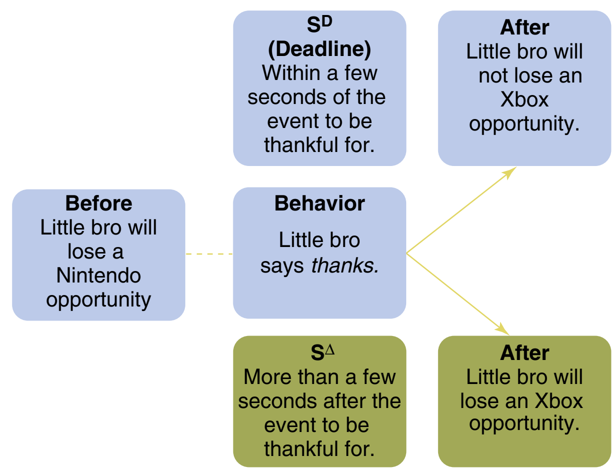
Are you ready for our next big predictions? First, we predict your little brother will say "thank you" so frequently he'll become a nuisance. And second, we predict you'll still have to get your slippers 6 out of 7 days a week; Fido will let you down, even though you ever so patiently explained the slipper and dog treat rule to him several times. Actually, we're so confident, you don't even need to mail us your data.

All this is to suggest two kinds of effective behavioral contingencies: One kind will control actions without language—giving Fido a dog biscuit immediately after he fetches your slippers. The other kind *may* control actions, but only if we bring language into the picture—the delayed reinforcer to your brother—but only if you state the rule describing the contingency. As we said before, we call these two types of contingencies **direct-acting contingencies** (dog biscuit within 60 seconds) and **indirect-acting contingencies** (a discriminated analog to the avoidance of the loss of the opportunity play video games 1 day later). In other words, reinforcers (and also aversive conditions) presented within 60 seconds that generate contingency control are involved in direct-acting contingencies.

Direct-Acting Contingency



Rules describing delayed outcomes are involved in indirect-acting contingencies.



And of course there's a deadline causing this to be an analog to avoidance of the loss of the opportunity to get a reinforcer, rather than an analog to simple reinforcement. Little bro can't wait until the end of the day and then say, "Oh, by the way, there are several acts of kindness which you performed for me today; and I would now like to take time out of my busy schedule to thank you for them." That won't get it.

(Note that skeptics may consider our experiment to be only suggestive, not a final proof of the importance of language and rule control. Your little brother and Fido differ in more ways than language. And one of those other differences might account for the difference in the results with these two subjects. For example, someone who really resists the notion of **rule-governed behavior** might suggest the crucial difference is not language but that Fido walks on all fours and your little brother doesn't. But remember, the indirect-acting contingency didn't work for your brother until we used language to tell him the rule describing that contingency.)

QUESTIONS

1. *Contingency-shaped behavior*—define it and give an example. (Yeah, we know we gave the definition a few sections back, but we're confident you can deal with it.)
2. Present an argument for the necessity of analyzing some sorts of behavior in terms of rule-governed behavior.

THE IMPORTANCE OF DEADLINES

It's 6:25 P.M., October 20, 1998. Sid drives his car at high speed through a residential neighborhood, risking life and limb of himself and any hapless soul on the street at that time. Cold sweat soaks his shirt. He slams on the brakes, grabs a file folder, hops out of the car, and leaving the door ajar, dashes into the Fed Ex office. The sign on the door says, *Office hours: 8:30 A.M. to 6:30 P.M., Monday through Friday*.

"Am I too late?" he asks.

"Just under the wire," she replies, with a condescending smile.

"I need overnight delivery. Got to get this symposium proposal to the Association for Behavior Analysis International tomorrow, or we won't be able to present our papers at ABA's conference."

Another condescending smile. Yes, she thinks, we should change our name to *Procrastinator's Express*.

It's the end of the day; she's tired; she's irritable; why not go for a little aggression reinforcer, to cheer her up? "If you had finished your proposal a few days earlier, you could have mailed it through regular mail, saved yourself some money, and not had to drive into our parking lot at 50 miles an hour."

Sid rubs his eye.

"I suppose they didn't tell you about the deadline until yesterday," she says, actually supposing no such thing, just probing a little harder for that aggression reinforcer.

Sid rubs his eye again and says, "No, I knew a little before that."

She wouldn't let up. "Oh, really, when?"

"A few months," Sid mumbles, as he fills out the mailing label.

The grand inquisitor rests her case, satisfied with her own moral superiority over this pathetic procrastinator. Besides, she needs to close the office as soon as possible in order to get home, where she and her husband have to dispose of the accumulation of 2 months of household neglect; her mother-in-law will be visiting them the next morning, and nothing pleases that woman more than finding a little dust on her daughter-in-law's windowsills.

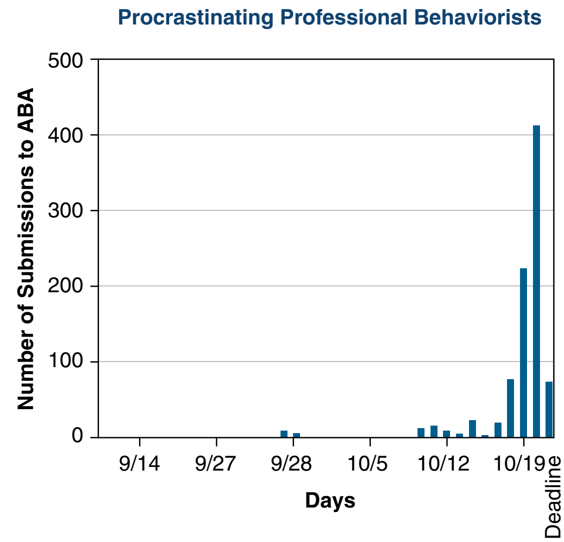


Figure 25.1 Procrastinating Professionals

Analysis

Fiction was first. Now the facts behind the fiction: Consider ABA's 1998 conference.[2] The submissions start trickling in at a rate of one or two every day or so (you can't even see them on the graph). The rate of submissions doesn't start getting serious until 3 days before the deadline. Figure 25.1 shows the number of submissions as a function of date. This is one of those pictures worth a thousand words.

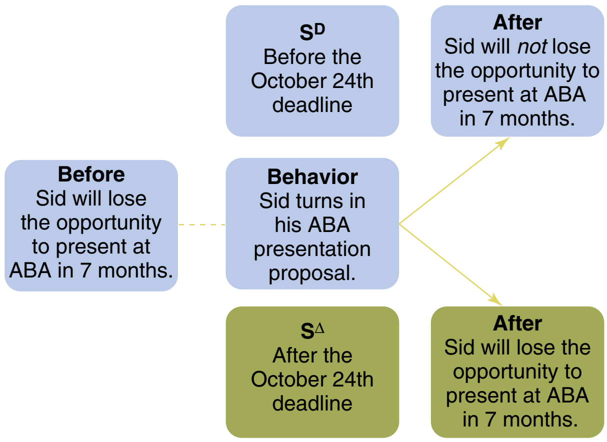
Does this mean the majority of ABA members, including the most famous people in behavior analysis, are all pathetic procrastinators? Well, yes, but no more than anyone else, or at least not much more.

Then why do so many people procrastinate so much? And what causes them to get it together at the last minute? Let's tackle the second question first.

Why Do Deadlines Control Our Behavior?

Question: What causes people to get it together by the last minute?
Answer: The deadline. The deadline, or at least the description of the deadline, is an S^D.

Analog to Discriminated Avoidance



Explanation: In the presence of the S^D, Sid's response of turning in his proposal will avoid the loss of the opportunity to present a paper at ABA, 7 months later. But, if he turns in his proposal after the deadline, turning in the proposal won't avoid the loss of that cherished opportunity. He would have missed the bus.

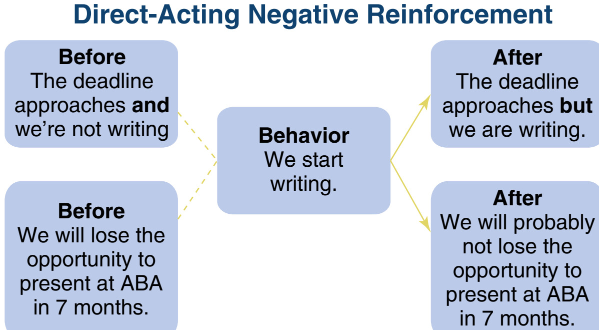
Suppose there were no deadline; then we could submit our proposals anytime we wanted. If we had to submit the proposals by the day of the conference, that's when we'd do it. But that's still a deadline.

Suppose we could wait until even after the conference. I think most proposals would never get submitted.

Why Do We Procrastinate?

Question: Why do so many of us procrastinate?
Answer: Because we don't break out into a cold-sweat panic until we can hear that deadline clock ticking.

Direct-Acting Negative Reinforcement



Indirect-Acting Avoidance Analogue

Explanation: Here's what I think is happening. As Sid and his fellow behavior analysts get closer to the deadline, the risk that they won't get their proposals written in time increases. We each have our own risk tolerance; but sooner or later, the risk of blowing the deadline gets so high, and thus so aversive, that eventually we start writing our proposals.

Now, a few people panic weeks before the deadline, and a few people don't panic soon enough to make the deadline. But by the time most people have gotten fairly close—but not too close, like within 4 days of deadline—their panic has become so aversive that they start to write their proposals. And that writing slightly reduces the aversive panic.

Another way to put it is that the approaching deadline is more aversive if we're not taking action than if we are (a conditional aversive stimulus). So Sid and the rest of us escape the extreme aversiveness of the approaching deadline combined with our inaction; we start to act and thus enter the somewhat less aversive condition of the deadline's approach while we're taking action. The approach of the deadline is still aversive, but less so; and that slight reduction in aversiveness is good enough to reinforce our escape response. (Rudolph would press the lever that reduced the intensity of the shock even if it didn't turn the shock completely off.)

But what about the 60-second test? This outcome follows the response by more than 60 seconds, so prevention of the loss that will happen 7 months after meeting the deadline is clearly too far removed to reinforce that response. Try that with Rudolph; try getting him to press the lever that prevents the occurrence of a shock 7 months later. No way.

The fact that our writing the proposal immediately reduces the aversiveness of inaction gets around the 60-second criterion. Without 1,800 behaviorists experiencing the deadline-proximity panic, there would be no ABA convention.

Of course, things are a lot easier now with electronic submissions. The procrastinators can hold off on submitting even longer, since they can complete their task from the comfort of their own desk chair. But we still tend to see the same pattern of submissions—a few trickling in when the system is first opened, and a mad rush as the final deadline nears.

INDIRECT-ACTING AVOIDANCE ANALOG

In summary, people procrastinate (put things off until the last moment) because they don't start to panic until they're near the last moment (the deadline). And they do get things done at the last moment because they escape their aversive fear of blowing the deadline by doing the thing they were putting off.

QUESTIONS

1. Why do so many people procrastinate so much?
2. And what causes them to get it together only at the last minute? Diagram and explain the relevant negative reinforcement and avoidance contingencies.
3. Why do we need deadlines to control our behavior?
4. Give an example that shows how people procrastinate up to the deadline.

Rule-Governed Behavior: Application

BEHAVIORAL SPORTS PSYCHOLOGY

The Offensive Backfield on a Pop Warner Football Team: Feedback vs. Praise[3]

Juke hadn't heard from Red since they'd played football together at BSU. So he was pleased to accept Red's invitation for dinner that Sunday. But Juke had learned that whenever long-lost friends call, a request for a favor usually follows. Sure enough, after they'd finished dinner and reviewed their 4 years of college glory, Red said, "Juke, I know you're busy, but I also know you like kids. I wonder if you could see your way clear to giving me a hand."

"Sure, Red, what's up."

"I got this Pop Warner football team I've been coaching—you know, 9- and 10-year-old kids. Been working with 'em a couple seasons."

"I heard about that. Glad you're givin' a little back to the kids, Red."

"Yeah, well I love the kids; but, jeez, these kids sure don't know how to play football. They're the worst team in the league. Everyone's down on 'em. Their folks are upset. The kids feel like losers, and they are. The whole mess is depressing. I don't want to do another season, but . . . you know."

"Yeah, I do know; you're gonna coach 'em anyhow. Well, remember what Coach Cochran never said."

"Huh?"

"It's not whether you win or lose, it's . . ."

"Cut it out, man. They lose, and they play a lousy game."

"Here's the way I see it, Red. Football's just like business and industry. It's the product vs. the process. Many folks think if you pay people off for a good product, the process will take care of itself. But I think that's often wrong. I think more often it's just the opposite."

"Whaddya mean, Juke?"

"I mean, you've got to look at the process—you've got to look at what it takes to succeed, to win the game, to produce the good product. You have to look at what the producer has to do to produce a quality product. You have to give 'em feedback on how well they're doing what needs to be done. And you have to pay 'em off when they do a good job on those component behaviors. You can't wait until they've finally produced a major product or won a game."

"Juke, you always were big on philosophy. Tell me what to do to win the game."

"First, you've got to forget about winning the game. Maybe forever and at least for now. You have to care about each of those kids—each one of 'em."

"I do."

"And your caring must lead to action. Care without action doesn't get it."

"Come on, Juke; stop preachin'. Tell me what to do."

"You've got to break the game into behavioral components—the plays."

"I do that already."

"Of course, but then you've got to break the plays into their components. And you've got to give each kid feedback and praise for each component of each play."

"Whenever the kids gain yardage or score a point, I congratulate 'em."

"Great. But I'm talkin' each component of each play."

"Sounds like a lot of details."

"That's my point. Take care of the details, and the big picture will take care of itself. Take care of the process, and the product will take care of itself."

Juke and Red spent many Sunday afternoons and many dinners doing the task analysis—more work and more details than even Juke had imagined. But more fun too. They worked

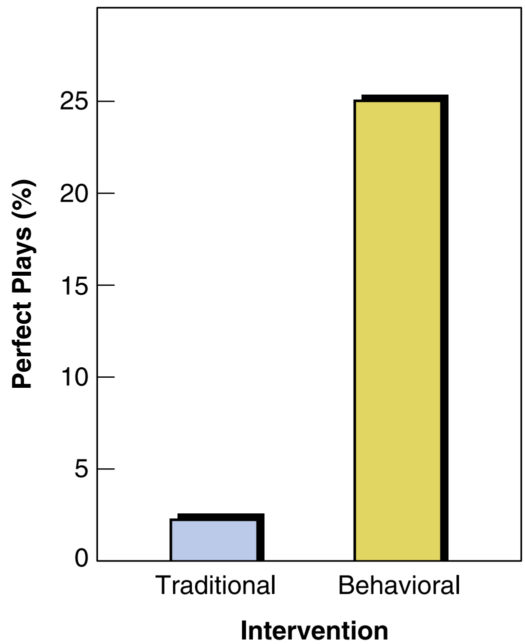


Figure 25.2 Rule-Governed Analogs to Avoidance, Combined With Feedback, to Increase Perfect Plays by a Boys' Football Team

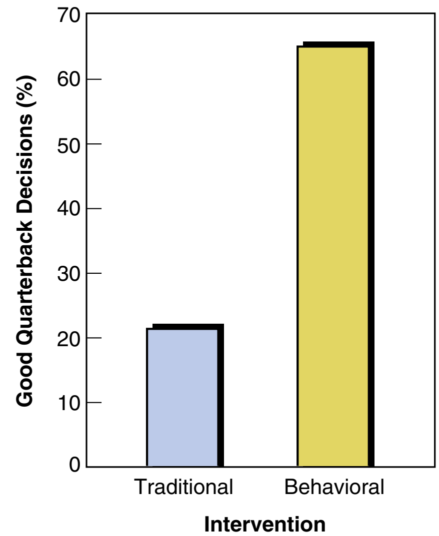


Figure 25.3 Rule-Governed Analogs to Avoidance, Combined With Feedback, to Increase Good Quarterback Decisions to Pitch or Keep for a Boys' Football Team

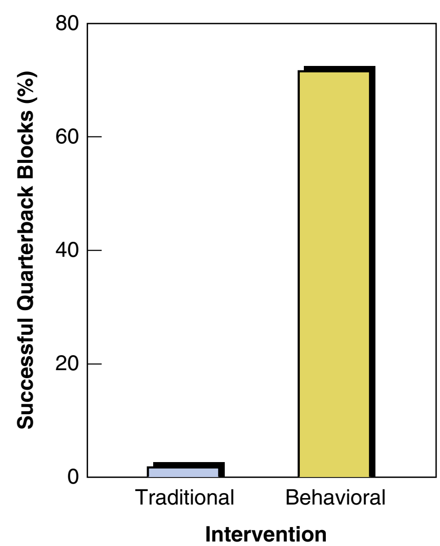


Figure 25.4 A Rule-Governed Analog to Avoidance, Combined With Feedback to Increase Good Quarterback Blocks for a Boys' Football Team

on three plays: the option play, the power sweep, and the off-tackle counterplay. They analyzed each of the three plays into five behavioral components. For example, in the option play, they had the quarterback-center exchange and the quarterback-right halfback fake among others, and they specified the detailed behavior sequence in each component.

Just as practice season began, Juke and Red completed the task analysis and prepared a checklist for each of the three plays' components. Red explained each component and gave its rationale. He modeled the proper movements, and he walked the backs through the plays. During the scrimmage sessions throughout the season, the players would run over to Red after each play, and Red would give them feedback by showing them how he had scored each of the five components of that play and explaining why. He pointed out not only what they had done wrong but also what they had done right on that play. He gave them lavish praise for each correct component. At the first practice session after each game, Red gave the players feedback, explanations, and, where appropriate, praise for the correct performance of each component of each play of that game.

The results? Each player played better, and each measure of performance of the backfield as a unit improved—the percentage of perfect play components and perfect plays increased, the percentage of lousy plays decreased, and the percentage of perfect quarterback decisions and quarterback blocks increased (Figures 25.2, 25.3, and 25.4). Each boy was winning, and the team was winning. Red became a sharper observer of the details of the kids' performance, and so did the kids themselves.

At the end of the season, Red said to Juke, "You know what I like best out of all the benefits of your behavioral intervention? That I've stopped getting on their cases all the time and started using praise. The kids are happier and I'm happier. Everyone works harder, everyone plays better, and everyone has more fun. And of course, we are all learning sportsmanship and teamwork."

Definition: GENERAL RULE REVIEW

Process vs. product

- Sometimes you need to
- make reinforcers and feedback contingent on
- the component responses of the process,
- not just the product (outcome).

Definition: CONCEPT REVIEW

Task analysis

- An analysis of complex behavior
- and sequences of behavior
- into component responses.

Remember that you only need to add feedback and reinforcers for the process when you can't get quality products of sufficient quantity, though you've provided feedback and reinforcers contingent on those products.

Definition: CONCEPT

Feedback

- Nonverbal stimuli or
- verbal statements
- contingent on past behavior
- that can guide future behavior.

Many behavior analysts look at feedback as if its function were to reinforce or punish the relevant behavior. We agree it may serve that function, but we also believe that function is incidental. When we say feedback *guides* behavior, we're saying that its stimulus control function is its defining feature. So we suggest that to function as a prompt for future behavior, feedback should occur as close as possible to that future behavior. And, contrary to the common view, we believe it need not follow the preceding response within 60 seconds, as it should if feedback were functioning to reinforce or punish that response.

This means we don't think feedback is a fundamental concept. We could talk about it simply as a prompt. But ***feedback** is a special type of prompt (or analog to a prompt), one relevant to the class of behavior that produces it*. So it is convenient to have a special name for that type of prompt (or prompt analog), and that name is **feedback**.[4]

QUESTION

1. Define and give an example of the following:
   a. *task analysis*
   b. the *process vs. product* general rule
   c. *feedback*

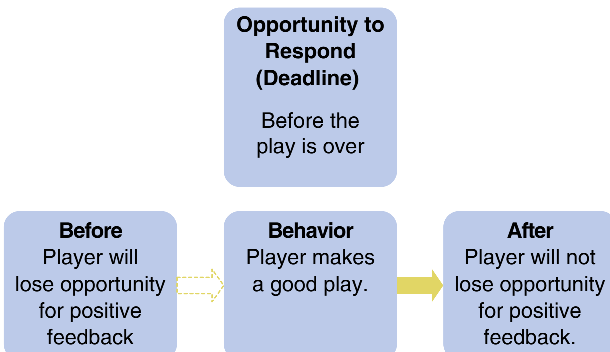
Analysis

What are we talking about here, a direct-acting contingency or its rule-governed analog, an indirect-acting contingency? Here's one way to think about it: Could the contingencies have controlled the behavior of a nonverbal animal? If they could have, then we're dealing with direct-acting contingencies. If not, then we must be dealing with an indirect-acting contingency—a rule-governed analog.

So could Red's contingencies have controlled a nonverbal animal? If we were really clever, we might be able to train Bonzo the chimpanzee to do a simple five-component play. At the end of each play, the chimp could trot over to the coach, and the coach could immediately give the chimp a banana. (Actually, we doubt if any of us are clever enough or patient enough to train a chimp to do as complex a play as these boys did if we were to give the bananas only at the end of the sequence—especially when the chimp is first acquiring the repertoire.) A no-brainer; Red's using indirect-acting contingencies. And what about the postgame feedback Red gave his team at the next session after each game? Another no-brainer. Clearly not simple direct-acting contingencies because the feedback occurred several days after the actual behavior. But you may need your brain to figure out what kind of indirect-acting contingency.

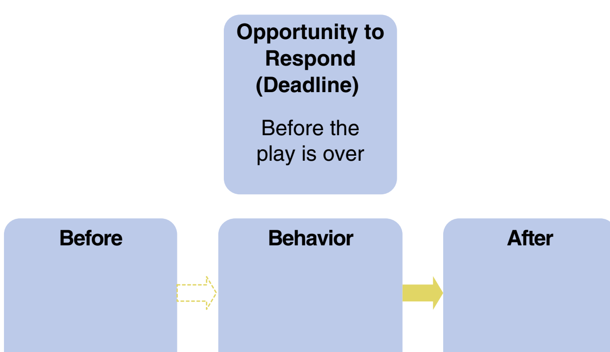
In earlier editions of this book, we described most of the contingencies in this chapter as analogs to reinforcement. But, now that we've become more sensitive to the omnipresence of deadlines, even where you least expect them, we should look for analogs to the avoidance of the loss of the opportunity to get a reinforcer.

Cool, but what's the deadline? A little hard to say, because each play consists of a series of continuous component responses, but let's just say the deadline is the end of the play (it would take two more pages of explanation to be more precise). And, if the player doesn't play it perfectly by the end of the play, he's forever lost the opportunity to hear Red's reinforcing approval for each component of that play.



But Red's feedback is a double-edged sword. If the player fails to make a good play, he'll receive Red's corrective feedback. Now that doesn't mean Red's going to beat up on the kid, but it's aversive to hear that you screwed up, no matter how tactfully that feedback is put; and Red isn't a master of tact. So, we've got another analog avoidance contingency—an analog to avoidance of an aversive criticism.

1. Please diagram this analog avoidance contingency—avoidance of Red's criticism:



But putting the avoidance contingencies on the whole sequence misses the point of feedback based on the task analysis Juke and Red spent so much time doing. Red didn't praise the whole chain of behavioral components that make up the play. He didn't just say, "Good work boys." He said, "Good work, on the second component—the fake component—but you were slow on the center exchange." (Try that on Bonzo and see what your graphs look like!) So we think the boys' behavior was under the control of rules like "Do the fake the same way next time and you'll have it right" and "Speed up the center exchange and you'll have a good play."

In summary, it's hard work to be crisp, alert, and do a complex, difficult play well. The players might prefer to dog it a bit. But if they don't play their best, they'll lose the opportunity for Red's positive feedback (a strong reinforcer for all the boys). So they do the hard work of executing the plays well, because that will avoid the loss of the opportunity to receive Red's reinforcers a few days later at the next practice.

QUESTION

1. Please diagram and explain the role of delayed feedback in a behavior-analytic coaching procedure.

Notes

1 Based on Tomlinson, J. R. (1970). Bowel retention. *Behavior Therapy and Experimental Psychiatry*, *1*, 83–85.

2 Dams, P. (1998). The ABA program book: A process analysis. *The ABA Newsletter*, *21*(3), 2–3.

3 Based on Komaki, J., & Barnett, F. T. (1977). A behavioral approach to coaching football: Improving the play execution of the offensive backfield on a youth football team. *Journal of Applied Behavior Analysis*, *10*, 657–664. The graphs are based on the same article.

4 By prompt analog, we mean a stimulus that functions like a prompt but is really a rule-governed analog to a prompt. In other words, the stimulus may precede the response by more than 60 seconds; so it probably wouldn't work with Rudolph, the rat, in the Skinner box. And feedback often precedes the next opportunity to respond by minutes, hours, days, and so on. And the only way it would control the behavior to which it was relevant is if the person would repeat the feedback right before making the next response. That's why it may be important to give feedback immediately before the next opportunity to respond, rather than right after the last response, contrary to popular dogma, and there's even some research to back it up: Aljadeff-Abergel, E., Peterson, S. M., Wiskirchen, R., Hagen, K. K., & Cole, M. L. (2017). Evaluating the temporal location of feedback: Providing feedback following performance vs. prior to performance. *Journal of Organizational Behavior Management*, *37*(2), 171–195.

CHAPTER 26

Rule-Governed Behavior: Theory

Behavior Analyst Certification Board 5th Edition Task List Items		
B-13.	Define and provide examples of rule-governed and contingency-shaped behavior.	Throughout
G-6.	Use of instructions and rules.	Pages 467–469 and throughout
G-19.	Use contingency contracting.	Pages 467–474

Theory

HOW DO RULES GOVERN OUR BEHAVIOR?

We've presented the slightly theoretical, and thus slightly controversial, notion that many contingencies of interest to behavior analysts are not direct-acting contingencies of reinforcement and punishment—a contradiction of the assumption behavior analysts had formerly made. And now, we present the slightly more theoretical, and thus even more controversial, set of notions about *how* rules control our behavior.

We'll start this theoretical analysis by reviewing a few of the important issues we've covered thus far in this book:

First, the environment exerts two major types of psychological control over our behavior—**operant control** (control by the relatively immediate consequences of our actions) and **respondent control** (control by the immediately preceding eliciting stimuli). Most of the behavior we've dealt with has been controlled by its immediate consequences.

Second, we may not have actually said it, but by default, we've implied that that's all there is; there ain't no more. However, many people find that implication aversive. Also, this narrow-mindedness doesn't make much sense, especially when you consider all the people working toward long-term goals with no obvious immediate reinforcers, no performance managers popping M&Ms into their mouths every few seconds—all the cases where **indirect-acting contingencies** seem to control our behavior.

Third, we also suggested that **rule-governed behavior** could explain the influence of indirect-acting contingencies—contingencies where the outcomes are too delayed to reinforce or punish the causal behavior. Does this mean we're abandoning our narrow-minded position that all our behavior is controlled by either immediate operant or respondent processes? Does that mean we think there's more to life than the ringing of bells, the immediate delivery of a bite of food or a friendly smile, the immediate cessation of electric shock?

No, we still think that's all there is, but the bell ringing and the food gobbling and the shock flinching can get much more subtle than we used to realize. We don't think we're being narrow-minded; instead, we're being strict and rigorous; we're not letting ourselves cop out with easy but superficial, false answers for these crucial issues of behavior analysis. We think that with the simple concepts presented in the first part of this book, behavior analysts can understand essentially all of human psychology, with its wonderful richness, depth, and complexity.

Yes, we still have some serious explaining to do. The concept of **rule-governed behavior** may explain the influence of indirect-acting contingencies, but now we have to move on to the fourth major issue—a new issue: What explains **rule-governed behavior**? Well, hold on, because here's where we get really theoretical—and controversial.

Theory

RULE STATEMENTS AS VERBAL (ANALOG) PAIRING PROCEDURES

Remember, as behavior analysts use the term, a *rule* is a description of a behavioral contingency. Many behavior analysts believe and/or used to believe these rules function as reinforcement-based or punishment-based S^Ds. That is, they believe rules are stimuli in the presence of which the specified response will be reinforced or punished. But that should also mean the absence of the rule is a reinforcement-based or punishment-based S^Δ—a stimulus in the presence of which the response will be less likely to be reinforced or punished. But rules don't usually work that way.

For example, the delicious taste of a fruit smoothie will be as likely to reinforce your drinking it, whether or not someone has given you a rule about how much you'd enjoy drinking it. And the pain of an electric shock will be as likely to punish your putting your fingers across the two terminals of your car's battery, whether or not someone has warned you of the danger. Yet someone might give you rules saying you'll like drinking the smoothie and you won't like touching the batteries. And probably those rules would govern your behavior, though not as S^Ds. Now maybe the following analysis will seem too restrictive in its use of S^D, but see if this theoretical interpretation makes sense to you.

The rule statement causes noncompliance with the rule to become an aversive condition. For example, you state the following rule to yourself: *If I don't start reading this chapter, I won't be ready for the quiz*. And after you've stated that rule, your goofing off produces an aversive condition. (Some would call that aversive condition "fear," or "guilt," or "anxiety," or "nervousness.") So stating the rule and not working is like turning on the shock in a negative reinforcement experiment. And working on your assignment is the escape response. Perhaps just starting to work reduces the aversiveness a bit; and finishing the assignment may allow you to escape completely from this rule-generated aversive condition. Is it this way with you?

We still have a direct-acting contingency controlling our rule-governed behavior, even when the rule describes an indirect-acting contingency. For example, the poor grade on the quiz or even the poor performance during the quiz would be too delayed from the behavior of studying to be part of a direct-acting contingency controlling that studying. The delayed grades could influence your studying only indirectly. But we think all operant control requires direct-acting contingencies; so this theory states that the direct-acting contingency is the negative reinforcement contingency based on the learned aversive condition that results from your stating the rule. The direct-acting contingency is the reduction in the aversiveness associated with noncompliance with the rule.

QUESTIONS

1. What's the conventional interpretation of the role of rule statements?
2. What is the *PoB* objection?
   a. State the *PoB* theory.
   b. Give an example illustrating that theoretical analysis. Warning: Students often get a lower quiz grade because they miss this one.

Theory

THE MYTHICAL CAUSE OF POOR SELF-MANAGEMENT

Years ago, I made what I then considered my first major contribution to psychology. It was the publication of the following insight: The problem of self-management is that our behavior is controlled by immediate outcomes and not by delayed outcomes. So we fail to do what's in our long-run best interest. (Then I reread one of Skinner's books and found he had said the same thing before me. Probably I had gotten the idea from him and then forgotten the source.)

In more recent years, I made what I now consider my first major contribution to psychology. It was the publication of the following insight: The problem of self-management is *not* that delayed outcomes fail to control our behavior. Poor control by delayed outcomes is *not* why we fail to do what's in our long-run best interest. (Then I reread Skinner's *Contingencies of Reinforcement* and found he had said the same thing before me. Probably I had gotten the idea from him and then forgotten the source. Moral: Read Skinner's books only once; then you won't experience the humiliation of discovering you're not an ivory-towered creator of brilliant insights but just a street dealer of secondhand ideas.) So now we propose the following as a falsehood, a myth:

Definition: FALSE PRINCIPLE

Mythical cause of poor self-management

- Poor self-management occurs
- because immediate outcomes control our behavior
- better than delayed outcomes do.

Here's a common version of that myth: Because we can't delay our gratification, we fail to act in our long-term best interest. You've heard it many times: *The problem with your generation is that you can't delay your gratification; you're too much into immediate gratification, not like your parents' and grandparents' generations*. Well, even if the older generations hadn't been dissing the younger generation in that way since Aristotle's time (yes, they really have), we'd still think it's a myth.

We call the preceding a false principle and a myth because we *do not* believe that poor self-management occurs because of the failure of delayed outcomes to control our behavior. True, we don't think delayed reinforcement works. But because of rule-governed behavior, delayed outcomes and rules describing those delayed outcomes can control our behavior. We *do* believe there are other reasons for our poor self-management, as you shall soon see.

Earlier, we gave several examples of behavior probably controlled by rules describing delayed outcomes: When your little brother says, "thank you," he will get 5 minutes extra Xbox time *one day later*. When you post that really cool picture of yourself on Facebook you'll get a handful of likes, maybe even a couple hearts *a day or so later*. When you applied to college, you heard from the admissions department *after a few months*. When football players make the right plays, they'll receive delayed feedback and praise, *after a few minutes*. When you study and then take an exam, you'll see the results posted, *after a few days* (at least, if your professor is really on top of her game). We looked at what was probably control by rules describing delayed outcomes in many cases of behavioral community psychology (especially in environmental concerns).

All these examples suggest that we can easily get our behavior under the control of rules describing delayed outcomes (as long as those outcomes are probable and sizable). In turn, our lack of difficulty suggests that delayed outcomes are not why we fail to do what's in our long-run best interest. However, the ease with which delayed outcomes control our behavior does *not* suggest that delayed outcomes reinforce and punish that behavior. It's just that those delayed outcomes can reliably, though indirectly, influence our behavior if we can state rules describing the contingencies in which those outcomes are imbedded.

So what's the behavioral myth of the cause of poor self-management? That our inability to cope with delayed outcomes (delayed gratification) is the major cause of our troubles in self-management. Instead, we think delayed outcomes don't cause us much of a problem. Of course, this is a controversial view (that's why we've put it so near the end of the book). Behaviorists have invested so many years thinking the other way that it's hard to turn around. It's true, most of the devil's delights involve immediate reinforcers.

Our behavior is always controlled by immediate reinforcers and immediate aversive consequences, for better or worse. And we're always swimming in a sea of concurrent contingencies. But rules stating sizable and probable outcomes can be our life raft, though the outcomes are delayed. Such rules act as the verbal pairing procedures we need. They create the aversiveness of the outcomes in effective contingencies that do battle with the devil's temptations. It'd be fairly easy to slow down to the speed limit when you saw a cop with a radar speed checker, even if the police are set up to let you whiz on by and would be content to send you your summons days later in the mail (they got your license number). Again, immediate contingencies are at the bottom of it all. It's just that rules specifying delayed outcomes can set up those immediate contingencies based on fear, guilt, or whatever you want to call that private hell that keeps us all more or less in line.

In the next section, we present what we consider the behavioral truth about the cause of poor self-management.

QUESTIONS

1. Define the *mythical cause of poor self-management*.
2. According to the authors, how important are delayed outcomes in causing problems of self-management?
    a. Please explain.
       Warning: Students often get a lower quiz grade because they miss this one.
    b. Give a couple of examples illustrating your explanation.

Theory

THE SMALL, BUT CUMULATIVE, OUTCOMES

If delayed outcomes aren't what hangs us up, what does? We think the biggest problem is when an immediate outcome for each specific instance of a behavior is too small to reinforce or punish that behavior, though the cumulative impact of many such outcomes may be large. For example, the harmful effects of one spoonful of ice cream are too small to punish the response of eating that spoonful. Those harmful effects only gradually sneak up from behind to bite you on your ever-expanding rear end. Those small, harmful effects are of only cumulative significance.

Doesn't that make sense, when you stop to think about it? Of course, the harmful effects of one spoonful are too small to punish even the tiny sin of eating that spoonful. "Yes," the skeptic replies, "but those harmful effects accumulate—into a significant outcome only after a considerable delay. So you haven't gotten rid of the problem of the delay. I still think the delay is mainly why people eat ice cream in spite of its deadly results."

True, the harmful outcomes of eating ice cream aren't part of a direct-acting contingency that punishes the behavior of eating, and that's for two reasons. One is that the immediate, harmful outcomes are too small. The other is that the sizable harmful outcomes are too delayed. But the question here isn't why the outcomes are not part of a direct-acting punishment contingency.

Question

Why do we have so much trouble following rules that specify those outcomes?

Our Answer

We think people have trouble following rules that specify outcomes that are small and of only cumulative significance. For example, suppose the following hypothetical rule were true: *If you eat one more bite of ice cream, you will gain 50 pounds, your blood pressure will enter the danger zone, your arteries will plug with plaque, and you'll have a mild heart attack. One little bite will definitely cause all these horrible things; however, those horrible things won't happen until exactly 1 year after that bite. But remember, just one bite will do it.*

I think even the skeptic must agree that most of us would shun that spoonful of ice cream as if it were connected to 220 volts and we were standing in a pool of water, at least if we believed the rule. In other words, the rule specifying the delayed disaster would effectively control our behavior.

But the following rule does a poor job controlling our behavior, even though it is true and most of us believe it: *If you continue eating ice cream, you will gradually gain 50 pounds, your blood pressure will gradually rise to the danger zone, your arteries will gradually plug with plaque, and you'll be at serious risk for a fatal heart attack (not just a mild one)*. Millions of people know and believe this true rule. But still this rule does a poor job of controlling their behavior. Why? Because one more bite won't hurt. Even one whole quart won't hurt. *Just one more, and then I'll stop*. Sure you will. Those small but relentlessly cumulative outcomes can kill you.

They also can be costly, as you probably know if you have a credit card. I'm not exactly sure how much I've charged to my card this month, but I'm sure it hasn't been too much. So I'll just buy these three new albums . . . oh, yes, and this one too, it's on sale. Yes, your debt to Visa can grow in a small but cumulative way until you're in deep Jell-O.

QUESTIONS

1. Give an example showing how rules describing small but cumulatively significant outcomes often fail to control our behavior.
2. Now change your example rule to show how a similar rule probably would control our behavior if the cumulative outcome were, instead, one single, though delayed, outcome.

Theory

THE IMPROBABLE OUTCOME

But there's more:

If everyone in the United States wore their seat belts, thousands of lives a year would be saved, tens of thousands of injuries would be prevented. By now, most of us know what a lifesaver seat belts are. But many would not regularly buckle up without special coercion in the form of the threat of tickets, and even then quite a few still fail to buckle up. In fact, before "click it or ticket" came along, fewer than 20% of us regularly buckled up.

And if everyone in the United States practiced safe sex, we'd virtually wipe out AIDS and other sexually transmitted diseases. Instead, they're wiping us out.

What does this mass stupidity illustrate? A cultural death wish? No, we think it shows that it's hard to follow rules specifying low-probability outcomes. In other words, the probability is very, very low that you'll be in a serious accident on any specific trip. However, if you were a professional daredevil, or a Hollywood stunt person, or racecar or demolition-derby driver, you'd probably buckle up, at least when you were on the job. Why? Because the probability of an aversive outcome is much higher than when you're driving to the supermarket.

Similarly, with AIDS, the probability that that cute boy or girl is a carrier is low. So why bother with a condom? However, if you knew the person had AIDS, you'd practice safe, safe, safe sex. Those low probabilities are killing us.

QUESTION

1. Give an example showing how rules describing improbable outcomes often fail to control our behavior.

Theory

THE TRUTH ABOUT THE CAUSES OF POOR SELF-MANAGEMENT

So let's summarize what we just discussed: People can easily follow rules describing indirect-acting contingencies, with delayed outcomes; they can easily follow those rules as long as those outcomes are sizable and probable (buy your plane ticket today so you can use it this coming weekend). Also, of course, people can easily follow rules describing direct-acting contingencies with sizable and probable outcomes (last call for boarding the plane). The delay to the outcome doesn't matter. But people have a heck of a time following rules that specify what we call ineffective contingencies—contingencies with small but cumulative outcomes (dieting) or improbable outcomes (buckling up).

Definition: PRINCIPLE*

Rules that are easy to follow

- Describe outcomes that are
- both sizable
- and probable.
- The delay isn't crucial.

* We distinguish between basic and higher-order principles of behavior analysis. ***Basic principles*** include the principles of reinforcement, punishment, and stimulus control. We cannot explain these principles with other still more basic principles of behavior analysis. ***Higher-order principles*** include the two principles describing the conditions that make rules hard and easy to follow. We think eventually someone will be able to explain them with the more basic principles such as the principles of reinforcement and punishment. Sometimes we don't know if a principle is basic or higher order. Herrnstein's probability matching law is another example of a principle whose status as fundamental or higher order is not agreed upon by everyone.

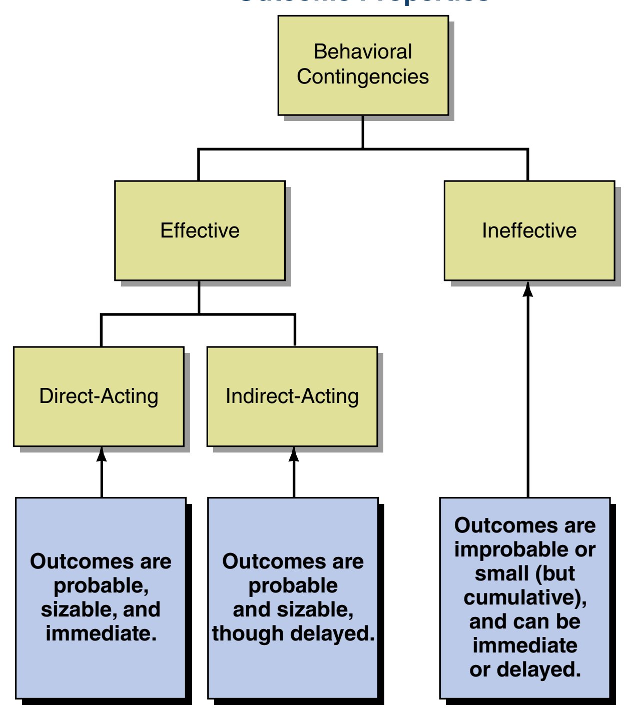
Also, we should note that these two principles concerning hard and easy rules are new kids on the block and not nearly as well established or accepted as are, for example, the law of effect or most of the other principles in this book. But we thought they were so important that you should know about them.

Rules that are hard to follow

- Describe outcomes that are either
- too small (though often of cumulative significance)
- or too improbable.

To summarize the last few sections, let's look at the diagram showing the relations among two types of rules and the three types of contingencies:

Contingency Tree with Outcome Properties



So, we have two types of rules—**easy to follow** and **hard to follow**. Rules that are easy to follow describe two types of contingencies—direct acting and indirect acting. For a contingency to be direct acting, the outcome must be all three—fairly immediate, probable, and sizable. (For example, in the Skinner box, the drop of water won't appreciably reinforce the lever press if it follows the response by too great a delay or with too low a probability or if it's too small. We've said that a reinforcer delayed by more than 60 seconds won't normally reinforce a response. Fewer data are available on the probability of a reinforcer, but we would guess that if the probability were as low as 1 in 100,000, the probability would be much too low for the contingency to effectively reinforce the response.) For a contingency to be indirect acting, the outcome must be delayed, but probable and sizable. (If the outcome wasn't delayed, the contingency would be direct acting. And, if the outcomes weren't both probable and sizable, the rule describing the contingency wouldn't control behavior—the rule would be hard to follow.)

Rules that are hard to follow describe ineffective contingencies. For a contingency to be ineffective (for verbal human beings), the outcome must be either improbable or small, whether it is or is not delayed. And that brings us to the correction of what we now consider a false principle.

Definition: PRINCIPLE

Real cause of poor self-management

- Poor self-management results from
- poor control by rules describing
- outcomes that are either
- too small (though often of cumulative significance)
- or too improbable.
- The delay isn't crucial.

QUESTIONS

1. *Rules that are easy to follow*—state the principle and give an example.
2. *Rules that are hard to follow*—state the principle and give an example.
3. Draw and explain the contingency tree with outcome properties.

Warning: May be crucial to getting a good grade on this quiz.

4. Define the real cause of poor self-management.

Theory

WHAT'S WRONG WITH SMALL BUT CUMULATIVELY SIGNIFICANT AND IMPROBABLE OUTCOMES?

As we've seen, a contingency may still be effective, though it is not direct acting. And the contingency is ineffective, even for verbal, rule-governed human beings, only when the outcomes are too improbable or too small, even if those outcomes are cumulatively significant.

Why do improbable and small outcomes often fail to control our behavior? Well, those contingencies fail to control our behavior, even indirectly, because the rules describing the contingencies are hard to follow.

So why are those rules hard to follow? According to our theoretical analysis, it's because those rules don't act as effective verbal pairing procedures. In other words, their statement doesn't create a sufficiently aversive condition. For example, consider this rule describing a low-probability outcome: I should buckle up because if I don't there's one chance in a million I'll be killed. Stating that rule fails to cause noncompliance to become a sufficiently aversive condition (a condition of fear, anxiety, whatever you want to call it). Therefore, escape from that condition of noncompliance will not reinforce buckling up, especially when buckling up is mildly effortful and mildly aversive. The same applies to the following rule describing a small but cumulatively significant outcome: I shouldn't eat this heavenly hot fudge sundae because if I do I will gain an unnoticeable amount of fat and be unnoticeably less beautiful and healthy. Stating that rule also fails to cause noncompliance to become a sufficiently aversive condition. And therefore, entering that condition of noncompliance will not punish pigging-out, especially when the taste of that sundae is such a powerful reinforcer.

Then why doesn't the statement of rules specifying low probability or small, but cumulative, outcomes create sufficiently aversive conditions? Sorry, we're still trying to figure out the answer to this third one. What's your answer?

Understand that this section is on the cutting edge of behavior analysis, and messing with cutting edges is risky. In other words, this section is even more theoretical and debatable than the previous one; but it's our best shot. Check out DickMalott.com for more discussion on the effectiveness of rules for different people.

QUESTION

1. Why does our behavior tend not to be controlled by contingencies with improbable or small but cumulative outcomes?

Theory

WHY DO WE MISS DEADLINES?

Let's look at another example. We have argued that it is easy to follow rules that specify delayed outcomes, as long as the outcomes are sizable and probable. Yet, a few times we ourselves have missed and almost missed planes and trains when the outcome of boarding the plane or train was delayed by an hour or more from the response of preparing to depart (for example, finishing some chores at home, packing, and starting for the airport or train station). Does this contradict what we've been arguing? We think not.

We think starting to prepare for departure involves a rule that can be hard to follow, but not because the outcome of departing is too delayed from the act of starting the preparation. Instead, according to the present theoretical analysis, the rule is hard to follow because it is not clear how much time we'll need to finish our chores, pack, and get to the airport. And being too optimistic, many of us tend to underestimate the time we need to get it all together. So, because we naïvely think we've still got plenty of time, our failure to comply with the rule, *I've got to get my rear in gear*, doesn't generate a very aversive condition. Therefore, escape from that not very aversive condition doesn't reinforce our actually getting it in gear.

We can always procrastinate just one more minute before starting to pack. Surely we can wait until the end of the *Gilmore Girls* rerun. Surely we can tidy up the house just a little bit. The outcome of waiting one more minute is too small and often achieves significance only after too many of those minutes have accumulated. Then it's panic city—"Oh my gosh, we're going to miss the plane!"

So, our theory is that, in general, failure to meet deadlines is a problem of small and cumulative outcomes resulting from the difficulty of estimating the time needed to complete large tasks before delayed deadlines. It is not a problem of delayed outcomes.

Remember this rule: It always takes twice as long as you had planned to perform a task, even when you considered this rule in your planning.

QUESTION

1. Using an example, explain why failure to meet a delayed deadline is a result of small and cumulative outcomes, not a result of delayed outcomes.

Theory

THE SECRET OF CONTINGENCY CONTRACTING

So what does all this theory say about contingency contracting?

It gives us a brand-new perspective. It gives us a new answer to the question: How do we manage performance? But first:

When do we need contingency contracting? We need contingency contracting when the natural contingencies do not effectively support the appropriate behavior.

Come on now, don't be a pedantic* pain. You know what we mean by *natural* contingencies. We mean the contingencies present in our work, in our home, in our school, in our life—the contingencies that cause all the problems the behavior analyst is called in to fix. In this context, by *natural* we don't mean "correct." The *natural* contingencies are the automatic, built-in (intrinsic), nonprogrammed contingencies, not the added (extrinsic), programmed ones.

And what do we mean by *appropriate behavior*? Behavior that does two things: (1) It increases the individual and the group's long-range contact with beneficial conditions; and (2) it also decreases contact with harmful conditions. (Often, though far from always, *beneficial conditions* means *reinforcers* and *harmful conditions* means *aversive conditions*.)

Nonverbal Clients

How do we manage the performance of nonverbal clients? We add or remove the direct-acting contingencies to supplement the ineffective natural contingencies, and/or we remove undesirable natural contingencies.

It's fairly common for ineffective natural contingencies to fail to reinforce many crucial behaviors for preverbal children with autism, for example looking at their parents, listening to them, imitating them, etc. And it's also fairly common for behavior analysts to supplement those ineffective contingencies with direct-acting reinforcement contingencies. In that way, many of those children have learned the prerequisites to verbal behavior and then verbal behavior itself.

Remember nonverbal Velma and Gerri, from Chapter 2? Unfortunately, the ineffective, natural contingency of damaged teeth did not punish their teeth grinding; so Blount and his colleagues added a direct-acting punishment contingency, an ice cube on their face, which did effectively suppress their harmful grinding.

* We thought you might want to add this to your active repertoire of high-class put-downs, even though it may not be on your quiz (you'll thank us later): pe dan tic *adjective*. Characterized by a narrow, often ostentatious (pretentious) concern for book learning and formal rules: a pedantic attention to details. *The American Heritage® Dictionary of the English Language* (3rd ed.). Copyright © 1992 by Houghton Mifflin Company. Electronic version licensed from INSO Corporation.

And remember baby Rod Field's incessant crying, from Chapter 2? And it took behavior analysts Dawn and Sid until Chapter 10 before they figured out they if they removed the direct-acting "natural" contingency (their contingent, reinforcing attention), their cute little baby's incessant crying would extinguish.

Theory

VERBAL CLIENTS AND THE INEFFECTIVE NATURAL CONTINGENCY

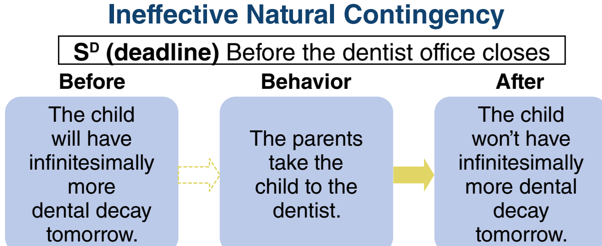
But what about verbal clients? We think the following answer is an important contribution of this theory of rule-governed behavior.

How do we manage the performance of verbal clients? Often we add indirect-acting contingencies to the ineffective natural contingencies. In other words, we supplement rules that are hard to follow by adding rules that are easy to follow. (Of course, sometimes we add or remove direct-acting contingencies.)

In one interesting study, the majority of parents didn't take their children to the free dental clinic, though the parents knew their children had dental problems.[1] Why not? Perhaps because the rule describing the natural contingency was hard to follow. What was the natural contingency? An analog to negative reinforcement (escape from an aversive condition)? Maybe not. The child's having a dental health problem most likely wasn't too aversive because the problem wasn't obvious—he or she didn't have a painful tooth. If the child had been crying because of a toothache, most parents would have rushed their child to the dentist.

Then what was the natural contingency? We think it was an ineffective analog to avoidance. Here's the hard-to-follow rule that describes it: If you take your kids to the dentist today, they will avoid infinitesimally more dental decay tomorrow. The trip to the dentist won't escape a current aversive condition but would avoid a future infinitesimal increase in aversiveness.

Ineffective Natural Contingency



This dental analog to an avoidance contingency works like this: The parent's going to the dentist that day has prevented the tiny increase in the amount of decay that would have come otherwise.

Why do avoidance contingencies control the behavior of rats, though this particular analog to an avoidance contingency fails to control the behavior of the parents? Maybe because the rats pressing the lever avoid something sizable—an electric shock that will otherwise come in the next few seconds. But the parent's taking the kid to the dentist today would avoid something that's too small—1 day's increase in decay. Even a dentist couldn't detect an extra day's decay.

Perhaps that's why the rule about taking the children to the dentist was hard to follow; its outcome was small and only cumulatively significant. If parents didn't take their children to the dentist today, nothing much would happen—just one more day's tiny contribution to poor dental decay. The parents could always go to the dentist tomorrow, or maybe the next day. In other words, we suspect most parents intended to take their children to the dentist but just never got around to it. We don't mean the cumulative outcome of their procrastination wouldn't be aversive to the parents. They'd find their children's poor dental health aversive, but they wouldn't find one more day's contribution to that poor dental health too aversive.

On the other hand, many people would argue that the dental analog contingency is ineffective because the outcome of serious dental problems is too delayed. But we think the delay is more or less irrelevant for verbal people. Let's look at this from another angle.

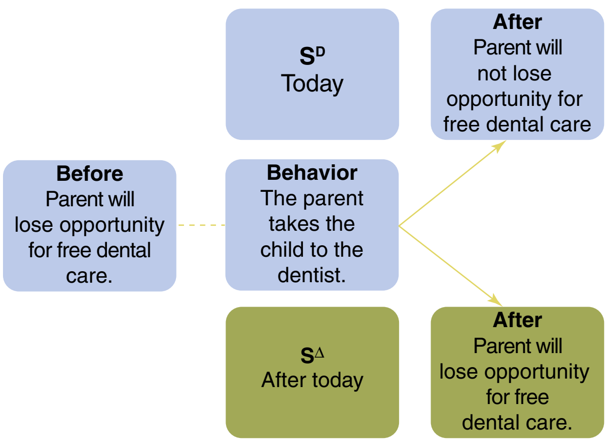
Theory

VERBAL CLIENTS AND EFFECTIVE INDIRECT-ACTING PERFORMANCE-MANAGEMENT CONTINGENCIES

To better understand this theoretical analysis, let's look at a prediction: Here's a rule that should work to reduce the procrastination of those poverty-level parents who value their kids' dental health. This rule would impose a deadline: *To receive free dental treatment, you must take your child to the dental clinic today. After today, the free services will end because the government is cutting back its support of social services.*

We suspect that's an easy rule to follow, in spite of the delay of the dental decay. We suspect almost all parents who believe the rule would take their kids to the dentist that day. Why? Because the outcome would be sizable (some serious cavities) and probable (definitely have the cavities), even though that outcome would be delayed. In summary, we argue it wasn't the delay; it was the small, though cumulative, nature of the aversive event being avoided that made the rule so hard to follow.* But, in fact, as a behavioral intervention, Maxine Reiss and her colleagues offered parents $5 for taking their kids to the dentist. Then the percentage of parents who helped their kids rose from 23% to 67%.

Hypothetical
Effective Performance Management Contingency



Does this mean the parents loved the $5 more than their kids? No way. Then why was the $5 rule so much easier to follow? Perhaps because the $5 rule allowed for less procrastination. The mean (average) income of the families was only $5,000. So they were living so close to the bone that they may have often been broke. Then that $5 might allow them to get something they wanted or needed right away, like enough food on the dinner table. And if they procrastinated, they'd have to go without dinner for one more day, a powerful procrastination preventer.

In other words, with the rule describing a natural contingency, one more day's procrastination only had a small effect—just one more day of dental decay. But with the performance-management rule, one more day's failure to respond had a large effect—for example, a day without enough to eat.

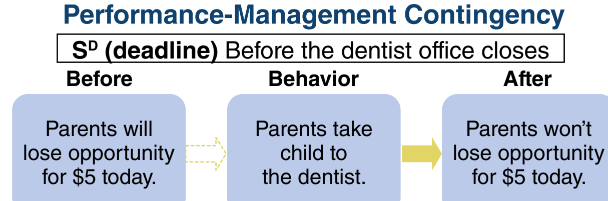
To be more technically precise: For the natural analog to be an avoidance contingency, the event being avoided (one more day's decay) was too small to be aversive enough to support the avoidance response. (The aversiveness was only cumulatively significant.) For the effective performance-management analog-to-an-avoidance contingency, the event being avoided (loss of an opportunity to buy enough food for the family dinner table) was aversive enough to support the avoidance response (taking the kids to the dentist).

The $5 contingency for low-income people may have implied a deadline: You must get to the dentist's office before closing time to avoid the loss of an opportunity to spend $5 on your family's dinner today. This "loss of an opportunity to spend $5 today" is getting complex; so let's discuss it.

In what sense do they have the opportunity to spend $5 today before they've even earned the $5? In the sense that before the dentist's office closes they still have a chance to earn the $5 and then spend it. After the office closes, they no longer have that chance. The opportunity to spend $5 today is a big reinforcer if you're running low on cash. So the contingency is an indirect-acting analog avoidance of the loss of a reinforcer—not the loss of the $5 (they don't have the $5 to lose); instead, the contingency involves the loss of the opportunity to spend the $5 today.

Ineffective Natural Contingency

Effective Indirect-Acting
Performance-Management Contingency



By the way, don't think we're being too outlandish by suggesting some people in the United States don't have enough money to buy dinner. Many of poverty's children go to bed hungry. But even if hunger weren't the case for many of the families Reiss worked with, they still might not have had enough money to go to the movies that night or buy gas for the car or whatever.

Finally, we need to do an even more speculative theoretical analysis to answer this question: **Why do rules stating or implying deadlines work?** In other words, how can we use the basic principles of behavior to explain the value of the $5 rule and the importance of the deadline rule? What are the direct-acting contingencies of reinforcement?

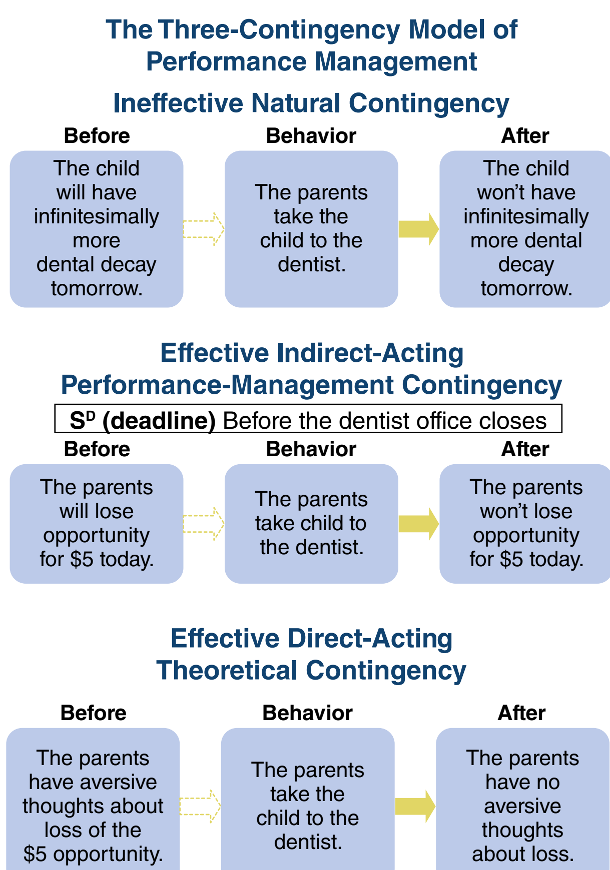
As we said earlier, stating such rules causes noncompliance to become a sufficiently aversive condition that escape from that

* A tip of the hat to Yvonne Hueng for helping with the analysis of this hypothetical contingency.

aversive condition reinforces compliance. In other words, the thought of losing the opportunity to spend the $5 today or missing the needed free dental care would be aversive enough that escape from that thought would negatively reinforce going to the dentist. But the thought of just adding one more day's worth of insignificant dental decay would not be aversive enough.

The parent states the rule, *I must get my kid to the dentist today, or I'll lose the chance to spend the $5 today*. That rule statement is a verbal analog to a ***pairing operation***. It causes noncompliance with the rule to become a learned, aversive ***before condition*** because then noncompliance produces aversive thoughts about the loss of the opportunity to spend the $5 when needed.

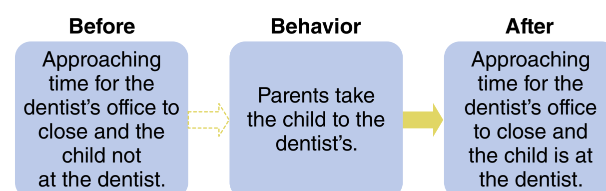
Incidentally, this analysis is an example of what we call the **three-contingency model of contingency contracting.** We use it to explain the need for contingency contracting and the effectiveness of indirect-acting contracted contingencies. You don't need the third contingency when the performance-management contingency is direct acting, as in the case of putting the ice cube on the face of a tooth-grinding client.



Definition: MODEL

> **Three-contingency model of contingency contracting**
>
> - The three crucial contingencies are the ineffective natural contingency,
> - the effective, indirect-acting performance-management contingency, and
> - the effective, direct-acting contingency.

Now, some behavior analysts are uncomfortable with the concepts *fear*, *anxiety*, and even *aversive thoughts* when we talk about that third contingency, the direct-acting one. But we can clean it up, though by adding a little more complexity. The aversive before condition in the third contingency is a conditional aversive condition: *approaching the deadline (time for the dentist's office to close)* ***and*** *not having made the response (not having taken the child to the dentist)*. And the parents escape that aversive condition by removing one of those conditional elements, by taking the child to the dentist; then, approaching the time for the office to close is no longer aversive.



Deadlines

Are we contradicting ourselves? We say people miss deadlines, and yet we say deadlines are often crucial to good contingency contracting. No, they often miss delayed deadlines, but fairly immediate deadlines are our saving grace. In Chapter 3, we told you that performance not monitored once a week turns to Jell-O; in other words, deadlines need to be coming up, at least within a week, if they are going to reliably control behavior.

OK, but then are we contradicting ourselves when we say rules must specify fairly immediate deadlines, and yet delayed outcomes aren't a problem? No, the rule should specify a fairly immediate *deadline*, though it can specify a delayed *outcome*. For example, *if you finish reading this chapter this week, your instructor will give you $100 at the end of the semester*. Because the deadline is fairly immediate, that rule would control the behavior of even the most notorious slacker, though the $100 outcome is way down the road.

Verbal Clients and Low-Probability Outcomes

We've been talking about the problems with small but cumulative outcomes and the lack of deadlines. What about the problems with low-probability outcomes? What about our national failure to wear seat belts? For example, in North Carolina, seat-belt use rose from an estimated 20% to 49% when buckling up became a state law. However, use rose further to 78% when failure to buckle up became what is called a *primary offense* (that means police could start ticketing motorists who failed to obey the buckle-up rule). The rise in buckling up from 49% to 78% was accompanied by a decline of 12% in fatalities and a decline of 15% in serious injuries.

How might we interpret this? The probability of legal sanctions increased somewhat when buckling up was made a law, and perhaps the probability of legal sanctions (fines) increased a bit when failure to buckle up became a primary offense (the size of the aversive outcome may also have increased). So now the probability of an aversive outcome for failure to comply seemed high enough to get fairly good compliance and save quite a few lives.

QUESTIONS

1. When do we need contingency contracting? Please explain and give an example.
2. How do we do contingency contracting with nonverbal clients? Please explain and give an example, including a contingency diagram.
3. How do we do contingency contracting with verbal clients? Please explain and give an example, including a contingency diagram.
4. Apply the three-contingency model to the problem of getting parents to take their children to the dentist.
5. Define the *three-contingency model of contingency contracting*.

Theory

AN ANALYSIS OF PROCRASTINATION[2]

We first started dealing with the ever-present problem of procrastination way back in Chapter 3, with Sid about to lose his job, because he was procrastinating on writing his dissertation. And Juke came to Sid's rescue with a contingency contract involving Sid's having to send $20 to the American Nazi Party whenever he procrastinated on his writing. Remember?

We have two questions to answer:

1. Why did a good student like Sid have so much trouble finishing his dissertation?
2. And why was the contingency contracting so effective in helping him finish his dissertation? (See the following section for the answer to this one.)

First, why so much trouble? People often make the mistake of thinking that if someone doesn't do something it's because that person doesn't care. Sid cared. He'd worked his tail off to get his PhD. He loved his job and didn't want to lose it. The problem was procrastination. Sid could always putter about the house and garden for just another hour or so. Not that he was avoiding his dissertation, in fact he enjoyed working on it, once he got started; it's just that he needed to finish weeding the tomato patch. Doing almost anything was less intellectually effortful than working on the dissertation.

Also, we've suggested that the typical behavioral myth doesn't apply. It wasn't that graduation was so far down the road; it wasn't that the outcome of his efforts would be too delayed.

The problem was that the progress Sid would make during any given hour of writing his dissertation was small compared to the total progress he needed to make. And the harmful results were insignificant for procrastinating just another hour or so or even another day or so. So his behavior wasn't controlled by the ineffective rule: I need to start writing my dissertation during this hour so I can make a tiny bit of progress toward getting my degree and keeping my job.

That rule described a small outcome of only cumulative significance. So a statement of that rule didn't cause *not writing* to become a very aversive condition. Therefore, even when he stated the rule, getting to work wasn't reinforced by the reduction of any heavy guilt, fear, anxiety, aversiveness, or whatever.

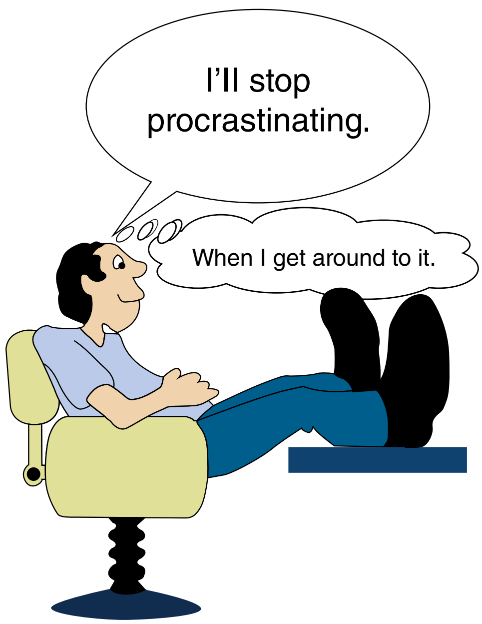
This doesn't mean Sid was not terribly upset about his problem. It doesn't mean he was not afraid he would lose his job. It means that starting to work right now wouldn't reduce that fear much. Why not? Because he really could still start in just a few minutes from now, and he'd be almost as close to finishing as if he'd start right now. What a problem!

Therefore, let us reword our first question: **Why is it that, without help, Sid and thousands of other bright, hardworking grad students just like him will flounder around and never graduate?** Here's our answer:

Stating the rule about immediately starting to write doesn't generate a very aversive condition. In more popular words,

the fear or anxiety isn't great enough. So actually starting to write will reduce only a mildly aversive condition or state of fear or anxiety, and won't even reduce it by very much. And that slight reduction in aversiveness isn't enough to reinforce the escape response of starting to write.

By the way, some students have objected that we were violating our own rule about not talking about non-behavior. Not so. You should not talk about non-behavior when you're trying to analyze a response. But non-behavior can be a stimulus. For example, the undertaker should always apply the dead-man test.



QUESTIONS

1. Why do good students often have so much trouble finishing their doctoral dissertations? Show how your answer applies to the actual writing of the dissertation.
2. Don't they really care about graduating? Please explain.
3. Graduation is a delayed outcome. Is that a serious problem? Please explain.

Analysis

UNIVERSITY TEACHING

The Contingency Contract

Now for our second question:

- **Why does help in the form of a contingency contract work?**

Because we need contingency contracting when the natural contingencies are ineffective in supporting appropriate behavior. The natural contingencies are often ineffective in supporting writing theses and dissertations or even writing postcards, for that matter.

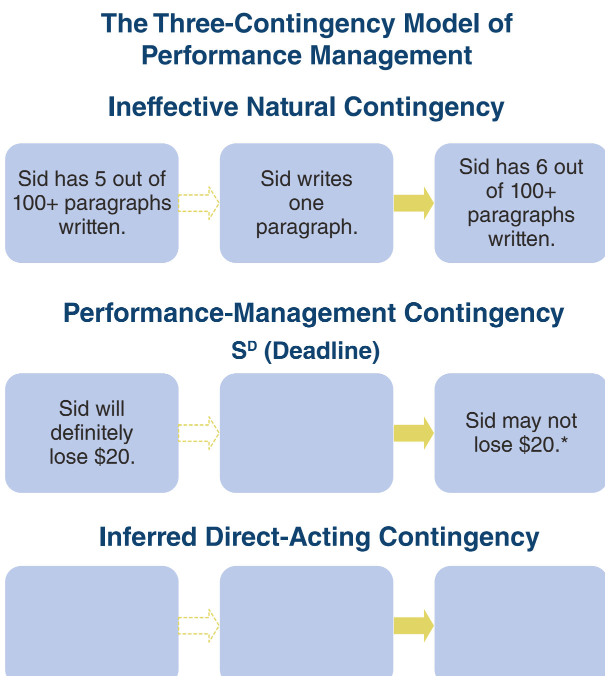
We often do contingency contracting with verbal clients by adding indirect-acting contingencies to the ineffective natural contingencies. We supplement rules that are hard to follow by adding rules that are easy to follow. Remember, Juke created a **contingency contract** to help his long-time buddy, Sid, who was having trouble getting his rear in gear to finish writing his dissertation: Juke adds easier-to-follow rules to the contingency contract. The new rule is: Do all your 12.3 hours of work before your meeting with Juke this Friday at 3:00 P.M., or it'll cost you at least $20 and some embarrassment and put you much closer to losing 2 hours' worth of dissertation credit. That's an outcome that's probable and sizable. So it's an easy-to-follow rule.

Furthermore, there's a limit to how much Sid can procrastinate. At the latest he can procrastinate until around 1:00 A.M. Friday. That would leave him just enough time to get his 12.3 hours of work done and brush his teeth. What this means is that as Sid uses his slack time, not writing becomes more and more aversive (because not writing generates more and more thoughts about losing the money, and so forth). Finally, his thoughts become so aversive he escapes that aversiveness by getting his rear in gear and his words written. Now he may not have waited until that close to the last minute before he started to work, but let's just say he was at his computer a lot more on Thursday and Friday than he was on Monday and Tuesday.

So here's our theoretical answer to, ***Why does help in the form of* a contingency contract *work?* Contingency contracts have rules that make it clear when you're dangerously off task; and those clear rules with their probable, sizable outcomes are effective verbal pairing procedures that support the reinforcement of getting on-task.**

The **ineffective natural contingency** involved the small, but cumulative, progress toward completing the research (and thus graduating) that resulted from each minute's work (ineffective indirect-acting reinforcement contingency). The **effective contracting contingency** could be indirect acting because it dealt with the behavior of verbal graduate students. This indirect-acting contingency involved the prevention of a definite and sizable, though delayed, loss of points that would move Sid much closer to losing some money and academic credit (effective indirect-acting contingency). The **theoretical, effective direct-acting contingency** involved the definite, sizable, and immediate reduction in the aversiveness caused by the statement of rules in the contingency contract (effective, direct-acting, negative reinforcement contingency). Note: **If there had been no deadline, the statement of those rules wouldn't have caused noncompliance to become such an aversive condition.** The fairly immediate deadline was crucial. We can summarize all this in our three-contingency model.

1. Please complete the following diagrams.



To have a reinforceable response unit, we just analyzed writing one paragraph rather than writing the entire dissertation. But the mammoth task of writing a dissertation consists of a series of smaller, reinforceable response units, like writing a paragraph. The outcome of having one more paragraph written is not a sufficient reinforcer to maintain paragraph writing in itself. The loss of $20 is (especially to the American Nazi Party). Notice that the deadline for writing the first paragraph isn't really Friday at 3:00 P.M. Friday at 3:00 P.M. is when he will lose the $20. But the deadline for starting the first paragraph is at least 12.3 hours before Friday at 3:00 P.M. In other words, the deadline for the response and the time the reinforcer will be lost need not be the same.

Always remember this: **Contingency contracts designed to increase or maintain behavior should specify outcomes that are**

- **sizable and**
- **probable.**

QUESTIONS

1. Why does help in the form of contingency contracts work? Please illustrate each component of your answer with an example.
2. Apply the three-contingency model to dissertation completion.
3. What kind of outcomes should be used in contingency contracts designed to increase or maintain behavior?
4. Would you like to be real cool? Well, let's see: You probably are or will be struggling to write up your doctoral dissertation, your master's thesis, your bachelor's thesis, your term paper, or a letter home. So why don't you set up a little contingency contract to give yourself that needed kick?

*If Sid does not write this paragraph he will definitely lose the $20. But if he does write it, he's still in the running, though he has a few more paragraphs to write before he's home free.

Theory

AN INTERACTION BETWEEN THE PROBABILITY AND THE SIGNIFICANCE OF THE OUTCOME

I was in paradise—sitting in my bathing suit on a large rock overlooking a tranquil, crystal-clear lagoon in the Galapagos Islands, off the west coast of South America. Eighty degrees and sunny. Perfect for a swim. The boat's skipper encouraged everyone to dive in. But the crystal-clear water revealed a school of a half dozen sharks, 3 to 6 feet long. Danger in paradise. The sharks didn't stop my French companions, nor the Ecuadorian skipper. But they stopped me, though the captain assured me that he'd swum many times with the sharks and had no problems.

No doubt the skipper was right. No doubt the probability of a shark attack was low. But the significance of a shark attack was extremely high. The rule describing the unlikely but highly significant outcome stopped me dead in my tracks, even though the same reinforcement contingency for swimming on that perfect day was in effect for me just as it was for my French and Ecuadorian companions.

Another time, I left my umbrella in the car when I came home from work. The radio said it might rain the next morning (then again, it might not). The probability of getting wet if I didn't get the umbrella was fairly high, but the significance was low. The rule describing the moderately probable, but only mildly significant, outcome had no effect. I went to bed.

No doubt whether a rule controls our actions is a function of both the probability and the size of the outcome that rule describes. If the outcome is significant (e.g., a shark attack), the rule may control our behavior, though the probability of that outcome is fairly low. If the outcome is not significant (getting briefly rained on), the rule may not control our behavior, though the probability of the outcome is fairly high.

But many people still have trouble following the buckle-up rule.

Grad student Yukiko Washio suggested that it's not a question of real probability but of imagined probability. The imagined probability of a shark attack is high after seeing *Jaws*. Not a bad point. And the imagined significance (severity) of the consequence is probably much higher as well.

Theory

CAN WE BUILD A WORLD FREE OF AVERSIVE CONTROL?

What do the hippie flower children of the 1960s and most behavior analysts of today have in common? The naïve belief that we can build a world free of aversive control.

Why Can't We Build a World Free of Aversive Control?

Our physical world is full of aversive control (for example, punishment contingencies when we touch the hot stove and negative reinforcement contingencies when we turn on the air conditioner). Of course, we continue to engineer toward a user-friendly, forgiving world—one where we won't accidentally touch the hot stove, one where the automatic thermostat on the air conditioner anticipates our escape response. But, unless we end up regressing to the womb, we will always need to deal with an occasional mildly aversive physical reality.

Furthermore, our modern psychological world is full of another, more subtle form of aversive control—the deadline. A *deadline* is a time and date when something bad will happen if you haven't previously made the right responses. The bad thing might be the presentation of an aversive condition: You will wake with frost on your nose if you don't close the windows before you go to bed. Or the bad thing might be the loss of a current or potential reinforcer: Your garden tools will rust if you don't pick them up before the night's dew.

The outcomes involved in these deadlines are often too delayed to reinforce or punish directly the causal behavior. Instead, according to one theory of rule-governed behavior, deadlines set up avoidance contingencies that indirectly control our behavior, causing us to avoid chattering teeth or the loss of clean tools.

These aversive outcomes control our behavior indirectly. People state rules describing the deadline contingencies. For example, I must take my cookies out of the oven in about 15 minutes or they'll burn. Such rule statements cause noncompliance to become a learned aversive condition. Oh, my gosh, the 15 minutes are up. I almost "forgot."* And we escape that aversive condition by complying: Excuse me while I take out the cookies.

One more example: class preparation (the student must prepare the next assignment and the teacher must grade the last assignment). You state this rule to yourself: I must be prepared by class time or I'll look bad. As class time approaches, the aversiveness (fear, anxiety, whatever) increases, until beads of cold sweat dot your forehead. At last you've reached your threshold of aversiveness, so you make the escape response—you get off your duff and prepare for class, just at the last moment, of course.

The deadline can involve such indirect-acting aversive conditions as being cold or looking bad. Or it can involve indirect-acting reinforcers like tasty cookies or looking good. In either case, the direct-acting contingency is an aversive negative reinforcement contingency; you effectively cope with the deadline by immediately escaping from or reducing a learned aversive condition—one associated with failure to comply with the rule that describes the deadline contingency. (Humble social validity of this analysis is provided by the frequent complaints people make about the high pressure [aversiveness] of deadlines.)

Why Can't We Live in a World Based Solely on Reinforcers, With No Aversiveness?

Because our world contains many aversive conditions, such as the painful stimulation of a hot stove. Furthermore, it contains many deadlines that fortunately control our behavior, but only through the escape from learned aversive stimuli (the fear or anxiety associated with noncompliance with relevant rules).

* In terms of behavior analysis, what's going on here? I failed to state the rule. Or my behavior is not under the control of the earlier-stated rule, and that loss of control is because of the time lapse since the rule statement. In a sense, if we kept restating the rule, we'd be cool, like repeating the phone number we just looked up in the phone book.

But Why Can't We Prepare for Class Simply as a Result of Reinforcement by the Presentation of Reinforcers?

We could, if we were pigeons in a Skinner box, reduced to 80% of our free-feeding weight, with no concurrent schedules maintaining incompatible behavior. We'd prepare for class way before the deadline if the experimenter gave us a bite to eat every time we read a page.

OK, but Why Can't We Use Large Enough Learned Generalized Reinforcers to Reinforce Our Preparing for Class Without Such Heavy Deprivation?

Suppose you get $10 as soon as you complete each page. Even that may not do the trick. You're still in procrastination city. You don't need the $10 right away; you can always do it later and catch a few zzz's now. Only two things will stop your procrastination: (1) an immediate need for the $10 (you're hungry and can buy food) or (2) escape from the learned aversiveness of approaching a deadline after which you can no longer earn the $10.

Then Why Not Build the Reinforcers Into the Task?

Well, we try. The built-in reinforcers are one of the main features of this book. We're doing our best to build in as many reinforcers as we can. And most students tell us we do a good job. Still, when do they usually read the book? Right before class, of course. Even literature teachers need the aversive control of deadlines to get their students to read such great authors as Shakespeare, Hemingway, and Updike. So teachers of behavior analysis are in no better position with lesser authors like us. But suppose Hemingway had been able to load his books with irresistible reinforcers; that's still not a general solution, because there just aren't enough Hemingways to go around.

Conclusion

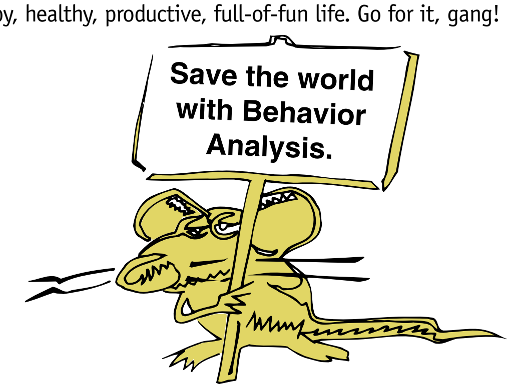
So the physical world has aversive control built into it, and deadlines demand aversive control if compliance is to be achieved. Furthermore, we can't realistically escape from the need for aversive control by using added unlearned reinforcers, added learned reinforcers, or built-in reinforcement contingencies. However, we can try to minimize our contact with aversive events. We can try to make our aversive control as unaversive as possible. Some mild but consistent aversive control is needed. But that doesn't mean we should shout at our kids, our friends, or our employees. It doesn't mean we should pollute our environment with self-indulgent temper tantrums when we don't get our way. It *does* mean we might try to make interactions with us so reinforcing that people will do anything to avoid losing those interactions (though we shouldn't be constantly beating them over the head with the threat of such losses).

QUESTIONS

1. Why can't we build a world free of aversive control?
   a. What are two types of aversive control provided by our physical world?
   b. What is the role of aversive control with deadlines?
2. Why can't we prepare for class simply as a result of reinforcement by the presentation of reinforcers?
3. Why can't we use large enough learned generalized reinforcers to reinforce our preparing for class without such heavy deprivation?
4. Why not build the reinforcers into the task?

ADDENDUM

Readin' over this chapter for the n^{th} time, and I finally realized that all the stuff on aversive control isn't the happiest way to end our book. Yeah, our lives can be full of aversive control that itself is so teensy-weensy we hardly notice it and don't appreciate its importance in helping us have a very happy, healthy, productive, full-of-fun life. So let me soften it up, just a teensy-weensy bit. The goal that Kelly and I have for *PoB* is to help you have a very happy, healthy, productive, full-of-fun life. Go for it, gang!



Notes

1 Reiss, M. L., Piotrowski, W. D., & Bailey, J. S. (1976). Behavioral community psychology: Encouraging low-income parents to seek dental care for their children. *Journal of Applied Behavior Analysis*, *9*, 387–396.

2 For an in-depth treatment of the issues and solutions surrounding procrastination, see Malott, R. W. & Harrison, H. (2012). *I'll Stop Procrastinating When I Get Around to It*. Kalamazoo, MI: Behaviordelia.

Thanks

Thanks

Truth is, I'm feeling a little emotional, as we wrap up this 8th edition of our book. So I decided to add this final "chapter." And true to form, I started the chapter with some smart-ass dialogue. But that didn't really work; so:

In reading our book, I hope you got at least a little chunk of the power of behavior analysis, its power to help us understand what's going on in the larger world and in your own personal world, at least a little bit, and also the power to help the larger world and your own personal world, at least a little bit.

Yeah, I know we've only hit on a small fraction of the issues in the world, at large, and even in your personal world. But at least it's a start. There's a lot more we could've covered, if we'd had more time, more energy, and twice as many pages. Behavior analysis is already covering many more areas than we've hit on; and with your help, it'll be covering even more areas, so we'll be able to better understand the world and work toward saving that fascinating, complex, loveable, and even hateable world.

I know our book will be a big, life-changing deal for some of you, a moderate deal for many of you, and a major disappointment for a few of you. And whichever, thank you so much for giving our *Principles of Behavior* a shot.

Dick Malott

Appendix: BCBA/BCaBA Task List (5th ed.)

INTRODUCTION

The BCBA/BCaBA Task List includes the knowledge and skills that serve as the foundation for the BCBA and BCaBA examinations.

STRUCTURE

The BCBA/BCaBA Task List is organized in two major sections, Foundations, which includes basic skills and underlying principles and knowledge, and Applications, which includes more practice-oriented skills.

Section 1: Foundations

A Philosophical Underpinnings
B Concepts and Principles
C Measurement, Data Display, and Interpretation
D Experimental Design

Section 2: Applications

E Ethics (Professional and Ethical Compliance Code for Behavior Analysts)
F Behavior Assessment
G Behavior-Change Procedures
H Selecting and Implementing Interventions
I Personnel Supervision and Management

Section 1: Foundations

A. Philosophical Underpinnings	
A-1	Identify the goals of behavior analysis as a science (i.e., description, prediction, control).
A-2	Explain the philosophical assumptions underlying the science of behavior analysis (e.g., selectionism, determinism, empiricism, parsimony, pragmatism).
A-3	Describe and explain behavior from the perspective of radical behaviorism.
A-4	Distinguish among behaviorism, the experimental analysis of behavior, applied behavior analysis, and professional practice guided by the science of behavior analysis.
A-5	Describe and define the dimensions of applied behavior analysis (Baer, Wolf, & Risley, 1968).
B. Concepts and Principles	
B-1	Define and provide examples of behavior, response, and response class.
B-2	Define and provide examples of stimulus and stimulus class.
B-3	Define and provide examples of respondent and operant conditioning.
B-4	Define and provide examples of positive and negative reinforcement contingencies.
B-5	Define and provide examples of schedules of reinforcement.
B-6	Define and provide examples of positive and negative punishment contingencies.
B-7	Define and provide examples of automatic and socially mediated contingencies.
B-8	Define and provide examples of unconditioned, conditioned, and generalized reinforcers and punishers.
B-9	Define and provide examples of operant extinction.
B-10	Define and provide examples of stimulus control.
B-11	Define and provide examples of disrimination, generalization, and maintenance.
B-12	
B-13	Define and provide examples of rule-governed and contingency-shaped behavior.
B-14	Define and provide examples of the verbal operants.
B-15	Define and provide examples of derived stimulus relations.
C. Measurement, Data Display, and Interpretation	
C-1	Establish operational definitions of behavior.
C-2	Distinguish among direct, indirect, and product measures of behavior.
C-3	Measure occurrence (e.g., frequency, rate, percentage).
C-4	Measure temporal dimensions of behavior (e.g., duration, latency, interresponse time).
C-5	Measure form and strength of behavior (e.g., topography, magnitude).
C-6	Measure trials to criterion.
C-7	Design and implement sampling procedures (i.e., interval recording, time sampling).
C-8	Evaluate the validity and reliability of measurement procedures.
C-9	Select a measurement system to obtain representative data given the dimensions of behavior and the logistics of observing and recording.
C-10	Graph data to communicate relevant quantitative relations (e.g., equal-interval graphs, bar graphs, cumulative records).
C-11	Interpret graphed data.
D. Experimental Design	
D-1	Distinguish between dependent and independent variables.
D-2	Distinguish between internal and external validity.
D-3	Identify the defining features of single-subject experimental designs (e.g., individuals serve as their own controls, repeated measures, prediction, verification, replication).

D-4	Describe the advantages of single-subject experimental designs compared to group designs.
D-5	Use single-subject experimental designs (e.g., reversal, multiple baseline, multielement, changing criterion).
D-6	Describe rationales for conducting comparative, component, and parametric analyses.

Section 2: Applications

E. Ethics	
Behave in accordance with the Professional and Ethical Compliance Code for Behavior Analysts.	
E-1	Responsible conduct of behavior analysts
E-2	Behavior analysts' responsibility to clients
E-3	Assessing behavior
E-4	Behavior analysts and the behavior-change program
E-5	Behavior analysts as supervisors
E-6	Behavior analysts' ethical responsibility to the profession of behavior analysis
E-7	Behavior analysts' ethical responsibility to colleagues
E-8	Public statements
E-9	Behavior analysts and research
E-10	Behavior analysts' ethical responsibility to the BACB
F. Behavior Assessment	
F-1	Review records and available data (e.g., educational, medical, historical) at the outset of the case.
F-2	Determine the need for behavior-analytic services.
F-3	Identify and prioritize socially significant behavior-change goals.
F-4	Conduct assessments of relevant skill strengths and deficits.
F-5	Conduct preference assessments.
F-6	Describe the common functions of problem behavior.
F-7	Conduct a descriptive assessment of problem behavior.
F-8	Conduct a functional analysis of problem behavior.
F-9	Interpret functional assessment data.
G. Behavior-Change Procedures	
G-1	Use positive and negative reinforcement procedures to strengthen behavior.
G-2	Use interventions based on motivating operations and discriminative stimuli.
G-3	Establish and use conditioned reinforcers.
G-4	Use stimulus and response prompts and fading (e.g., errorless, most-to-least, least-to-most, prompt delay, stimulus fading).
G-5	Use modeling and imitation training.
G-6	Use instructions and rules.
G-7	Use shaping.
G-8	Use chaining.
G-9	Use discrete-trial, free-operant, and naturalistic teaching arrangements.
G-10	Teach simple and conditional discriminations.
G-11	Use Skinner's analysis to teach verbal behavior.
G-12	Use equivalence-based instruction.
G-13	Use the high-probability instructional sequence.
G-14	Use reinforcement procedures to weaken behavior (e.g., DRA, FCT, DRO, DRL, NCR).

G-15	Use extinction.
G-16	Use positive and negative punishment (e.g., time-out, response cost, overcorrection).
G-17	Use token economies.
G-18	Use group contingencies.
G-19	Use contingency contracting.
G-20	Use self-management strategies.
G-21	Use procedures to promote stimulus and response generalization.
G-22	Use procedures to promote maintenance.
H. Selecting and Implementing Interventions	
H-1	State intervention goals in observable and measurable terms.
H-2	Identify potential interventions based on assessment results and the best available scientific evidence.
H-3	Recommend intervention goals and strategies based on such factors as client preferences, supporting environments, risks, constraints, and social validity.
H-4	When a target behavior is to be decreased, select an acceptable alternative behavior to be established or increased.
H-5	Plan for possible unwanted effects when using reinforcement, extinction, and punishment procedures.
H-6	Monitor client progress and treatment integrity.
H-7	Make data-based decisions about the effectiveness of the intervention and the need for treatment revision.
H-8	Make data-based decisions about the need for ongoing services.
H-9	Collaborate with others who support and/or provide services to clients.
I. Personnel Supervision and Management	
I-1	State the reasons for using behavior-analytic supervision and the potential risks of ineffective supervision e.g., poor client outcomes, poor supervisee performance).
I-2	Establish clear performance expectations for the supervisor and supervisee
I-3	Select supervision goals based on an assessment of the supervisee's skills.
I-4	Train personnel to competently perform assessment and intervention procedures.
I-5	Use performance monitoring, feedback, and reinforcement systems.
I-6	Use a functional assessment approach (e.g., performance diagnostics) to identify variables affecting personnel performance.
I-7	Use function-based strategies to improve personnel performance.
I-8	Evaluate the effects of supervision (e.g., on client outcomes, on supervisee repertoires).

Glossary

Abolishing operation (AO). An operation that *decreases* the effectiveness of a reinforcer.

Addictive reinforcer. A reinforcer for which repeated exposure is a motivating operation.

Aggression principle. Negative reinforcers and extinction are motivating operations for aggression reinforcers.

Aggression reinforcer. A reinforcing stimulus resulting from acts of aggression.

Alternating-treatments design. An experimental design in which the replications involve presenting different values of the independent variable in an alternating sequence under the same general conditions or in the same experimental phase, while measuring the same dependent variables.

Applied behavior analysis. The use of experimental research to discover ways to use the basic principles of behavior to solve socially significant problems.

Autoclitic. A verbal operant that modifies the effect of other verbal operants.

Automatic reinforcement. The response itself automatically produces the reinforcer.

Avoidance contingency. Response-contingent *prevention* of a negative reinforcer resulting in an *increased* frequency of that response.

Avoidance-of-loss contingency. Response-contingent *prevention of loss* of a reinforcer resulting in an *increased* frequency of that response.

Backward chaining. The establishment of the final link in a behavioral chain, with the addition of preceding links until the first link is acquired.

Baseline. The phase of an experiment or intervention where the behavior is measured in the absence of an intervention.

Behavioral chain. A sequence of stimuli and responses. Each response produces a stimulus that reinforces the preceding response and is an S^D or operandum for the following response.

Behavioral contingency. The occasion for a response, the response, and the outcome of the response.

Behavioral skills training (BST). Instructions, modeling, practice, and feedback.

Behavior analysis. The study of the principles of behavior.

Behavior trap. Use an added reinforcement contingency to increase the rate of behavior. Then the behavior can be reinforced by natural reinforcement contingencies, and those natural contingencies can maintain that behavior.

Behavior. A muscular, glandular, or neuro-electrical activity.

Behaviorism. The philosophy that the subject matter of psychology is the study of the effects of environmental variables on behavior, largely through experimental analysis.

Changing-criterion design. An experimental design in which the replications involve interventions with criteria of differing values.

Check the assumed reinforcer first. Before spending much time trying to reinforce behavior, make sure you have a true reinforcer.

Concept training. Reinforcing or punishing a response in the presence of one stimulus class and extinguishing it or allowing it to recover in the presence of another stimulus class.

Conceptual stimulus control (conceptual control). Responding occurs more often in the presence of one stimulus class and less often in the presence of another stimulus class because of concept training.

Concurrent contingencies. More than one contingency of reinforcement or punishment is available at the same time.

Conditional stimulus. Elements of a stimulus have their value or function only when they are combined; otherwise, the individual elements may be neutral.

Conditioned punisher. A stimulus that is a punisher because it has been paired with another punisher.

Conditioned reinforcer (secondary reinforcer). A stimulus that is a reinforcer because it has been paired with another reinforcer.

Conditioned response (CR). A response elicited (caused) by a conditioned stimulus.

Conditioned stimulus (CS). A stimulus that elicits (causes) a response because of previous pairing with another stimulus.

Confounded variables. Two or more independent variables have changed at the same time, so it is not possible to determine which of those variables caused the changes in the dependent variable.

Contingency contract (behavioral contract or performance contract). A rule statement describing the desired or undesired behavior, the occasion when the behavior should or should not occur, and the added outcome for that behavior.

Contingency-shaped behavior. Behavior under the control of a direct-acting contingency.

Continuous reinforcement (CRF). A reinforcer follows each response.

Control condition. A condition not containing the presumed crucial value of the independent variable.

Control group. A group of participants not exposed to the presumed crucial value of the independent variable.

Dead-man test. If a dead man *can* do it, it probably *isn't* behavior.

Dependent variable. A measure of the participant's behavior.

Deprivation. Withholding a reinforcer increases its effectiveness.

Derived stimulus relation. The relation between two or more stimuli is derived from independent training with those stimuli and other stimuli with which they have a relation.

Determinism. All events and all things have a cause.

Different before condition test. Does the S^D differ from the before condition?

Differential reinforcement of alternative behavior (DRA). Withholding reinforcement for an inappropriate response, while providing reinforcement for an appropriate response.

Differential reinforcement of incompatible behavior (DRI). Reinforcement is contingent on a behavior that is incompatible with another behavior.

Differential reinforcement of other behavior (DRO). A reinforcer is presented after a fixed interval of time if the response of interest has *not* occurred during that interval.

Differential-punishment procedure. Punishing one set of responses and not punishing another set of responses.

Differential-reinforcement. Reinforcing one set of responses and not reinforcing another set of responses.

Direct-acting contingency. A contingency in which the outcome of the response reinforces or punishes that response.

Discrimination training procedure. Reinforcing or punishing a response in the presence of one stimulus and extinguishing it or allowing it to recover in the presence of another stimulus.

Discriminative stimulus (S^D). A stimulus in the presence of which a particular response will be reinforced or punished.

Don't say rule. With nonverbal organisms, don't say *expects*, *knows*, *thinks*, *figures out*, *in order to* (or *so that he, she, or it could . . .*), *tries to*, *makes the connection*, *associates*, *learns that*, *imagines*, or *understands*. With any organisms, don't say *wants*.

Dual-functioning chained stimuli. A stimulus in a behavioral chain reinforces the response that precedes it and is an S^D or operandum for the following response.

Duration. The time from the beginning to the end of a response.

Echoic. Imitation of the vocal behavior of another speaker.

Empiricism. Knowledge comes from our senses.

Errorless discrimination procedure. The use of a fading procedure to establish a discrimination, with no errors during the training.

Error of reification. To call an invented explanation a thing.

Establishing operation (EO). An operation that *increases* the effectiveness of a reinforcer.

Experimental analysis of behavior. The use of experimental research to discover the effects of environmental variables on behavior, resulting in the basic principles of behavior.

Experimental group. A group of participants exposed to the presumed crucial value of the independent variable.

Experimentation. The manipulation of events or conditions to evaluate their effects.

External validity. The extent to which the conclusions of an experiment apply to a wide variety of conditions.

Extinction. *Stopping* the positive or negative reinforcement contingency for a previously *reinforced* response causes the response frequency to *decrease*.

Extinction/recovery test. Is the S^{Δ} contingency always extinction or recovery?

Fading procedure. At first, the S^D and S^{Δ} differ along at least one irrelevant dimension, as well as the relevant dimensions. Then the difference between the S^D and S^{Δ} is reduced along all but the relevant dimensions, until the S^D and S^{Δ} differ along only those relevant dimensions.

Feedback. Nonverbal stimuli or verbal statements contingent on past behavior that can guide future behavior.

Fixed-interval (FI) schedule of reinforcement. A reinforcer is contingent on the first response after a fixed interval of time since the last opportunity for reinforcement.

Fixed-interval scallop (fixed-interval pattern of responding). A fixed-interval schedule often produces a scallop—a gradual increase in the rate of responding, with responding occurring at a high rate just before reinforcement is available. No responding occurs for some time after reinforcement.

Fixed-outcome shaping. Shaping that involves no change in the value of the reinforcer, as performance more and more closely resembles the terminal behavior.

Fixed-ratio (FR) schedule of reinforcement. A reinforcer is contingent on the last of a fixed number of responses.

Fixed-ratio pattern of responding. After a response is reinforced, no responding occurs for a period of time, then responding occurs at a high, steady rate until the next reinforcer is delivered.

Fixed-time schedule of reinforcer delivery. A reinforcer is delivered after the passage of a fixed period of time, independent of the response.

Forward chaining. The establishment of the first link in a behavioral chain, with the addition of successive links, until the final link is acquired.

Functional assessment. An assessment of the contingencies responsible for problem behaviors.

Generalized conditioned reinforcer (generalized secondary reinforcer). A conditioned reinforcer that is a reinforcer because it has been paired with a variety of other reinforcers.

Generalized imitation. Imitation of the response of a model without previous reinforcement of imitation of that specific response.

Generative verbal behavior. Novel verbal behavior that has not been directly trained.

Group experimental design. A separate group of individuals serves as the control for the experimental group.

Higher-order respondent conditioning. Establishing a conditioned stimulus by pairing a neutral stimulus with an already established conditioned stimulus.

Imitation. The form of the behavior of the imitator is controlled by similar behavior of the model.

Imitative reinforcers. Stimuli arising from the match between the behavior of the imitator and the behavior of the model that function as reinforcers.

Incidental teaching. The planned use of behavioral contingencies, differential reinforcement, and discrimination training in the student's everyday environment.

Independent variable. The variable the experimenter systematically manipulates to influence the dependent variable.

Indirect-acting contingency. A contingency that controls the response, though the outcome of the response does *not* reinforce or punish the response.

Ineffective contingency. A contingency that does not control behavior.

Informed consent. Consent to intervene in a way that is experimental or risky. The participant or guardian is informed of the risks and benefits and of the right to stop the intervention.

Initial behavior. Behavior that resembles the terminal behavior along some meaningful dimension and occurs at least with a minimal frequency.

Intermediate behavior. Behavior that more closely approximates the terminal behavior.

Intermittent reinforcement. Reinforcement schedule in which a reinforcer follows the response only once in a while.

Internal validity. Lack of confounding variables.

Interobserver agreement. Agreement between observations of two or more independent observers.

Intervention (treatment) package. The addition or change of several independent variables at the same time to achieve a desired result, without testing the effect of each variable individually.

Intraverbal. A verbal operant under the stimulus control of other verbal operants.

Latency. The time between the signal or opportunity for a response and the beginning of that response.

Law of effect. The effects of our actions determine whether we will repeat them.

Listener behavior. Behavior under the stimulus control of a speaker.

Mand. A request for a reinforcer.

Matching law. When two different responses are each reinforced with a different schedule of reinforcement, the relative frequency of the two responses equals the relative value of reinforcement on the two schedules of reinforcement.

Matching to sample. Selecting a comparison stimulus corresponding to a sample stimulus.

Medical-model myth. An erroneous view that human problem behavior is a mere symptom of an underlying psychological condition.

Mentalism. The philosophy that the mind controls behavior.

Methodological behaviorism. The philosophy that behaviorism should only deal with events that two or more scientists can observe.

Mind. The source of cognitive skills or those cognitive skills themselves.

Motivating operation (MO). An operation that affects the effectiveness of a reinforcer.

Multiple-baseline design. An experimental design in which the replications involve baselines of differing durations and interventions of differing starting times.

Mythical cause of poor self-management. Poor self-management occurs because immediate outcomes control our behavior better than delayed outcomes do.

Naming. When one stimulus is an S^D for a response, then the stimulus associated with that response is also an S^D for a response to the first stimulus, without explicit training to establish that other stimulus as an S^D.

Negative punishment contingency (penalty). Response-contingent *removal* of a reinforcer resulting in a *decreased* frequency of that response.

Negative reinforcement contingency (escape). The response-contingent removal of a negative reinforcer resulting in an *increased* frequency of that response.

Negative reinforcer (aversive stimulus). A stimulus that increases the future frequency of a response that its *removal* (*termination*) follows.

Objective measure. The criteria for measurement are completely specified in physical terms and the event being measured is public and therefore observable by more than one person.

Operandum (manipulandum). That part of the environment the organism operates (manipulates).

Operandum test. Does the S^D differ from the operandum?

Operant behavior. Behavior that operates on the environment and is influenced by its reinforcing or punishing consequences.

Operant conditioning. Reinforcing or pushing consequences immediately following a response increase or decrease in future frequency.

Operant level. The frequency of responding before reinforcement.

Operational definition. An explicit definition that makes it possible for two or more observers to identify the same behavior when it occurs.

Overcorrection. A contingency on inappropriate behavior requiring the person to engage in an effortful response that more than corrects the effects of the inappropriate behavior.

Pairing procedure. The pairing of a neutral stimulus with a reinforcer or punisher.

Parsimony. The use of no unnecessary concepts, principles, or assumptions.

Performance maintenance. The continuing of performance after it was first established.

Physical prompt (physical guidance). The trainer physically moves the trainee's body in an approximation of the desired response.

Positive punishment contingency (punishment). The response-contingent presentation of a punisher resulting in a *decreased* frequency of that response.

Positive reinforcement contingency (reinforcement). The response-contingent presentation of a reinforcer resulting in an *increased* frequency of that response.

Positive reinforcer (reinforcer). A stimulus that increases the frequency of a response it follows.

Pragmatism. Research should have useful results.

Process vs. product. Sometimes you need to make reinforcers and feedback contingent on the component responses of the process, not just the product (outcome).

Professional practice guided by the science of behavior analysis. The use of the basic and applied principles of behavior to solve socially significant problems.

Prompt. A supplemental stimulus that raises the probability of a correct response.

Punisher (aversive stimulus). A stimulus that decreases the future frequency of a response that its *presentation* follows.

Radical behaviorism. The philosophy that behaviorism can consider many private events as behavior to which the principles of behavior apply.

Real cause of poor self-management. Poor self-management results from poor control by rules describing outcomes that are either too small (though often of cumulative significance) or too improbable. The delay isn't crucial.

Recovery from punishment. Stopping the positive or negative punishment contingency for a previously punished response causes the response frequency to increase to its frequency before the positive or negative punishment contingency.

Reflexivity. The matching of two identical stimuli; A=A.

Reinforce behavior. Reinforce behavior, not people.

Repertoire. A set of skills.

Resistance to extinction and intermittent reinforcement. Intermittent reinforcement makes the response more resistant to extinction than does continuous reinforcement.

Resistance to extinction. The number of responses or the amount of time before a response extinguishes.

Respondent conditioning. Pairing a neutral stimulus with an unconditioned stimulus causes it to elicit the conditioned response.

Respondent extinction. Presenting the conditioned stimulus without pairing it with the unconditioned stimulus, or with an already established conditioned stimulus, and the conditioned stimulus will lose its eliciting power.

Response class. A set of responses that serve the same function (produce the same outcome).

Response-cost contingency. The response-contingent removal of a *tangible* reinforcer resulting in a decreased frequency of that response.

Response dimensions. The physical properties of a response.

Response test. Is the response the same for both the S^D and the S^Δ?

Response topography. The sequence (path of movement), form, or location of components of a response relative to the rest of the body.

Reversal design. An experimental design in which we reverse the intervention and baseline conditions to assess the effects of those conditions.

Rule. A description of a behavioral contingency.

Rule-governed analog. A change in the frequency of a response because of a rule describing the contingency.

Rule-governed behavior. Behavior under the control of a rule.

Rules that are easy to follow. Describe outcomes that are both sizable and probable. The delay isn't crucial.

Rules that are hard to follow. Describe outcomes that are either too small (though often of cumulative significance) or too improbable.

Same before condition test. Is the before condition the same for both the S^D and the S^Δ?

Satiation. Consuming a large amount of a reinforcer decreases its effectiveness.

Schedule of reinforcement. The way reinforcement occurs because of the number of responses, time since reinforcement, time between responses, and stimulus conditions.

S-delta (S^Δ). A stimulus in the presence of which a particular response will not be reinforced or punished.

Selectionism. Characteristics of species, behavior, and societies are selected by their consequences.

Self-management. The use of a contingency contract where the person whose behavior is being managed determines/performs one or more components of that contract.

Seven dimensions of applied behavior analysis. Applied, behavioral, analytic, technological, conceptually systematic, effective, and general.

Shaping with punishment. The differential punishment of all behavior *except* that which more and more closely resembles the terminal behavior.

Shaping with reinforcement. The differential reinforcement of only the behavior that more and more closely resembles the terminal behavior.

Sick social cycle (victim's negative reinforcement model). In escaping the perpetrator's aversive behavior, the victim unintentionally reinforces that aversive behavior.

Sick social cycle (victim's punishment model). The perpetrator's aversive behavior punishes the victim's appropriate behavior, and the victim's stopping the appropriate behavior unintentionally reinforces that aversive behavior.

Single-subject experimental design. Individuals serve as their own controls.

Social validity. The goals, procedures, and results of an intervention are socially acceptable to the client, the behavior analyst, and society.

Socially mediated reinforcement. Another person (or organism) provides the reinforcer.

Spontaneous recovery. A temporary recovery of the extinguished behavior.

Stimulus class (concept). A set of stimuli, all of which have some common physical property.

Stimulus dimensions. The physical properties of a stimulus.

Stimulus discrimination (stimulus control). The occurrence of a response more frequently in the presence of one stimulus than in the presence of another, usually as a result of a discrimination training procedure.

Stimulus equivalence. Stimuli are equivalent when they have symmetrical, transitive, and reflexive relations but do not have common physical properties.

Stimulus generalization. The behavioral contingencies in the presence of one stimulus affect the frequency of the response in the presence of another stimulus.

Stimulus-equivalence training. The training of stimuli using symbolic match to sample that produces stimulus equivalence.

Stimulus-generalization gradient. A gradient of responding showing an increase in stimulus control as the test stimulus becomes less similar to the training stimulus.

Subjective measure. The criteria for measurement are not completely specified in physical terms or the event being measured is a private, inner experience.

Superstitious behavior. Behaving as if the response causes some specific outcome, when it really does not.

Symmetry (symmetrical stimulus control). When a stimulus is an S^D for one response, then the stimulus associated with that response will be an S^D for the response associated with the first stimulus.

Symptom substitution myth. Problem behaviors are symptoms of an underlying mental illness. So if you get rid of one problem behavior ("symptom"), another will take its place, until you get rid of the underlying mental illness.

Systematic desensitization. Combining relaxation with a hierarchy of fear-producing stimuli, arranged from the least to the most frightening.

S^Δ test. Is there also an S^Δ? (If not, then you also don't have an S^D.)

Tact. Labeling a stimulus.

Target behavior. The behavior being measured, the dependent variable.

Task analysis. An analysis of complex behavior and sequences of behavior into component responses.

Terminal behavior. Behavior not in the repertoire or not occurring at the desired frequency; the goal of the intervention.

Theory of generalized imitation. Generalized imitative responses occur because they automatically produce imitative reinforcers.

Three-contingency model of contingency contracting. The three crucial contingencies are the ineffective natural contingency, the effective, indirect-acting performance-management contingency, and the effective, direct-acting contingency.

Time-out contingency. The response-contingent removal of *access to* a reinforcer resulting in a *decreased* frequency of that response.

Token economy. A system of generalized conditioned reinforcers in which the organism that receives those generalized reinforcers can save them and exchange them for a variety of backup reinforcers later.

Total-task presentation. The simultaneous training of all links in a behavioral chain.

Transfer of training. Performance established at one time in one place now occurs in a different time and place.

Transitivity. When one stimulus is the S^D for two different responses, then the stimulus associated with one of those two responses will be an S^D for the other of those two responses.

Treatment (intervention) package. The addition or change of several independent variables at the same time to achieve a desired result, without testing the effects of each variable individually.

Unconditioned punisher. A stimulus that is a punisher, though not as a result of pairing with another punisher.

Unconditioned reinforcer. A stimulus that is a reinforcer, though not as a result of pairing with another reinforcer.

Unconditioned response (UR). A response elicited (caused) by an unconditioned stimulus.

Unconditioned stimulus (US). A stimulus that elicits (causes) a response without previous pairing with another stimulus.

Value-altering principle. The pairing procedure converts a neutral stimulus into a conditioned reinforcer or conditioned punisher.

Variable-interval (VI) schedule of reinforcement. A reinforcer is contingent on the first response *after* a variable interval of time since the last opportunity for reinforcement.

Variable-interval pattern of responding. Variable-interval schedules produce a moderate rate of responding, with almost no post-reinforcement pausing.

Variable-outcome shaping. Shaping that involves a change in the value of the reinforcer, as performance more and more closely resembles the terminal behavior.

Variable-ratio (VR) schedule of reinforcement. A reinforcer is contingent on the last of a variable number of responses.

Variable-ratio pattern of responding. Variable-ratio schedules produce a high rate of responding, with almost no post-reinforcement pausing.

Verbal behavior. Behavior reinforced through the mediation of other persons.

Verbal prompt. A supplemental verbal stimulus that raises the probability of a correct response.

Warning stimulus. A stimulus that precedes a negative reinforcer and therefore becomes a conditioned negative reinforcer.

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