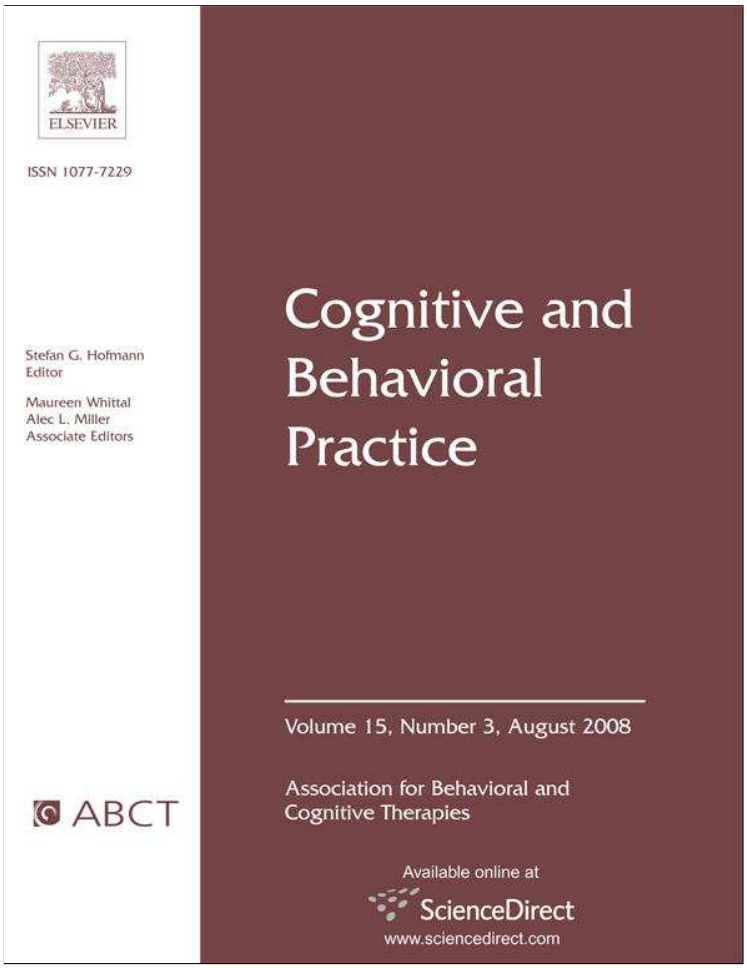

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A Primer on Functional Analysis

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Life Skills Resource

This article presents principles and basic steps for practitioners to complete a functional analysis of client behavior. The emphasis is on application of functional analysis to adult mental health clients. The article includes a detailed flow chart containing all major functional diagnoses and behavioral interventions, with functional assessment questions directing the reader through the chart. The model presented incorporates both operant and classical conditioning and a strategy for selecting target behaviors consistent with behavioral principles. Finally, the article describes the continuing role of functional analysis in effective behavioral intervention and its potential advantages over other forms of assessment in contemporary cognitive-behavioral therapy.

Functional analysis emerged early in the history of behavior therapy (actually prior to behavior therapy itself) as a way of applying the fledgling science of behavior to the practice of behavior change (see Ferster, 1972; Kazdin, 1978; Sidman, 1960; Skinner, 1953). Thus, it might be considered the most primary in this journal's series of "primers" in cognitive and behavioral therapy. Yet, the behavioral interventions to which a functional analysis can lead the practitioner (e.g., Bootzin & Epstein, 2000; Hopko, Lejuez, Ruggiero, & Eifert, 2003; Rothbaum, Meadows, Resick, & Foy, 2000) are arguably the most powerful components of contemporary cognitive behavioral therapy (Dimidjian et al., 2006; Jacobson et al., 1996; Taylor, 2004).

Functional analysis is a scientific approach to the individual case. It guides the practitioner to effective interventions from observations of possible causal or maintaining variables in an individual client's problems and/or goals, providing the critical link between assessment and intervention that has been a cornerstone of behavior therapy. Functional analysis provides a framework for case conceptualization and other complex clinical judgments (for example, see Haynes, Leisen, & Blaine, 1997; Virués-Ortega & Haynes, 2005). It can help identify sources of resistance to change (see Edelstein & Yoman, 1991) and strategies to promote persistence of change after intervention ends (see Baer, Wolf, & Risley, 1968, 1987). Because most practitioners are more familiar with the application of functional analysis to children (e.g., Albano & Morris, 1998; Scotti, Mullen, & Hawkins, 1998; Sulzer-Azaroff & Pollack, 1982), this article will emphasize application of functional analysis to adults.

Consistent with behavioral practice, we begin this primer on functional analysis by defining our terms. *Functional analysis* is a fundamental tool of applied behavior analysis[1] for examining the relationship between behavior and the environment. In performing a functional analysis, the practitioner describes the behavior of interest and its antecedents and consequences in observable measurable terms. *Observable terms* means that the thing described can be picked up with one of the five human senses, usually sight or hearing. Sometimes observation is assisted by special instruments (e.g., biofeedback equipment). *Measurable terms* means that the observations can be objectively recorded in the form of a number (e.g., frequency, latency, duration, intensity, etc.). (Note that the frequency, latency, duration, or intensity of categorical variables such as a "sad" or "happy" facial expression might also be recorded.) Objective recording of observations means that the reliability of data from the observa-

[1] "Applied behavior analysis" is "the science in which procedures derived from the principles of behavior are systematically applied to improve socially significant behavior to a meaningful degree and to demonstrate experimentally that the procedures employed were responsible for the improvement in behavior" (Cooper, Heron, & Heward, 1987, p. 14). It usually concerns the relationships between behavior and non-laboratory environments such as workplaces, schools, and clinics. In common usage, "Behavior modification" refers more specifically to the implementation of behavior change methods discovered by applied behavior analysis. "Behavior therapy" tends to refer even more specifically to the implementation of behavior change methods (only some of which were discovered by applied behavior analysis), usually with persons suffering from mental health problems. (See Martin & Pear, 1999, for further discussion of these distinctions.)

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tions can be calculated (e.g., the extent to which one observer assigns the same number to the same sample of behavior on different occasions, or the extent to which two or more observers assign the same number upon observing the same sample of behavior).

In this manner, the practitioner of functional analysis uses the scientific method to describe three components within the analysis, form hypotheses about their interrelationships, and then test those hypotheses. A functional analysis is sometimes called an "A-B-C analysis" after these three components: antecedents, behaviors, and consequences.

Functional Analysis in Operant Conditioning

The component typically described first in functional analysis is the behavior of interest. A *behavior* is the observable action of a living organism (in the case of behavior therapy, a person). For example, the behavior of interest for a client with substance abuse problems might be lighting and inhaling from a pipe filled with marijuana. For a client entering therapy for help with shyness, the behavior of interest might be calling a friend to invite him to a social activity.

The next component described is the antecedent (or antecedents) of that behavior. An *antecedent* is a stimulus (event observable by the person) which precedes the behavior of interest. Antecedents are also known as *discriminative stimuli*, in that they signal that a particular response will be followed by a certain consequence, allowing a person to discriminate when to respond. There are two primary types of discriminative stimuli: S^Ds and S^Δs. An S^D signals that a certain consequence will follow the behavior; an S^Δ signals that it will not. For example, Azrin and Hayes (1984) trained males seeking help to improve heterosocial skills to discriminate interest from female visual face and body cues. They found that this training alone improved role-played social skills in their participants. While Azrin and Hayes purposely did not specify discriminative stimuli in their study (successful discrimination does not require the ability to verbally identify the discriminative stimulus), S^Ds for initiation of interaction might have included the woman maintaining eye contact and showing a "felt smile" (Ekman & Friesen, 1982). S^Δs for initiation of interaction might have included looking away, frowning, or fidgeting in a particular way.

The third component of functional analysis, a *consequence*, is a stimulus that follows the behavior. There are two main types of consequences: a reinforcer and a punisher (see Fig. 1). A *reinforcer* is a consequence that increases the strength (i.e., frequency, duration, intensity) of the behavior it follows. A *punisher* is a consequence that decreases the strength of the behavior it follows. Notice that these two types of consequences are defined by their effect on behavior and not the expectation or intention of the practitioner. This is important because reinforcers and punishers often defy what the practitioner expects or intends. For example, praise is often delivered with the expectation that it will reinforce the behavior it follows. In fact, it often does not.

Fig. 1 depicts the four main types of consequences. To determine the type of consequence a practitioner has observed, he or she follows five steps: (a) *define the behavior* of interest in behavioral measurable terms (see above); (b) *observe whether the behavior is increasing or decreasing* in strength to determine whether the consequence is a reinforcer or a punisher; (c) *identify the consequence and define it* in behavioral measurable terms; (d) *determine whether the identified consequence is being added to or withdrawn from the environment* (i.e., is it positive or negative, respectively); and (e) reproduce or "replicate" the increase or decrease in the behavior by adding and withdrawing the consequence. The following examples illustrate these five steps as noted in parentheses:

A depressed client's frequency of completing planned activities (behavior) increases (reinforcer) after questioning in an animated vocal tone how the client accomplished this (consequence) is introduced (positive) by the practitioner after activity completion. Planned activity completion decreases when the animated questioning is withheld after several instances of activity completion, then increases again when the animated questioning is reintroduced after activity completion (replication), demonstrating that the animated questioning is a *positive reinforcer.*

A Generalized Anxiety Disorder client's frequency of practicing progressive relaxation (behavior) increases (reinforcer) after she experiences that ongoing muscle tension and other uncomfortable bodily cues of stress (consequence) decrease (negative). Replication is more complex with internal physiological stimuli which cannot be systematically introduced or withdrawn. However, negative reinforcement might be demonstrated in this case by reproducing the effect with a similar behavior: deep breathing relaxation. If the practitioner taught the client this technique, and the frequency of practicing breathing relaxation increased only when the client reported a decrease in muscle tension and other stress cues, then the practitioner would have demonstrated that the decrease in the bodily stress cues is a *negative reinforcer.* (Note that negative reinforcement involves termination of an ongoing aversive stimulus.[2])

A wife's disclosure of angry feelings (behavior) decreases in frequency (punisher) when her husband's

[2] An aversive stimulus is one which a person has a history of averting from (turning away) or avoiding. Whether an aversive stimulus is a punisher, whether it's cessation is a negative reinforcer, or neither, depends on its relationship to a specific behavior of interest.

		EFFECT ON CLIENT'S BEHAVIOR	
		Increases Strength	Decreases Strength
PRACTITIONER ACTION	Add (+) Stimulus	Positive Reinforcer	Positive Punisher
	Subtract (-) Stimulus	Negative Reinforcer	Negative Punisher (Response Cost)

Figure 1. Consequences of behavior.

criticizing her and saying she should be ashamed (consequence) starts (positive) after each such disclosure. If the wife's disclosure of angry feelings increases with cessation of the husband's criticism, this supports the hypothesis that criticism is a *positive punisher*. Due to the inadvisability of reintroducing criticism and shaming after disclosure of angry feelings, the practitioner might demonstrate the suppressive effect of criticism with a similar behavior. For example, if criticism and shaming follow the wife's admitting mistakes, the practitioner could get the husband to agree to cease criticism and shaming after this behavior. If the wife's admitting mistakes now increased, the reversal of the punishing effects of criticism and shaming would have been replicated with a second behavior.

A socially anxious client's asking others out to dinner (behavior) decreases in frequency (punisher) after several co-workers' eye contact and conversation (consequence) abruptly breaks off (negative) after the client invites them to dinner. Again, direct replication of this effect would be undesirable. However, with the client's permission, members of the client's social skills group might plan to break off eye contact and conversation after a similar behavior, such as asking questions of group members, without identifying the specific behavior to the client. If questions by the client decreased during the group intervention period (replication), then breaking off eye contact and conversation are a *negative punisher* (also called "response cost"). (Note that it might be quite instructional to discuss data from this group experiment to teach members about discriminating and overcoming the effects of social punishment.)

Reinforcers can also be classified as primary or secondary, depending on how they were established as reinforcers. Primary or unconditioned reinforcers are those we respond to instinctively, usually because they meet a basic need. We are born working to gain most primary reinforcers (e.g., food). Their power over our behavior doesn't require prior learning. Secondary or conditioned reinforcers, on the other hand, gain their power through pairing with primary or other established (secondary) reinforcers. For example, a baby may learn to work for the sight of his mother's smile because that smile is paired with the offer of food.

Adding Classical Conditioning to Functional Analysis

Although functional analysis emerged out of the study of operant conditioning (i.e., how behavior operates on the environment to produce consequences), considering classical conditioning (also known as respondent conditioning) in a functional analysis facilitates description and change of a broader range of behaviors. The behaviors involved in classical conditioning differ from those in operant conditioning, in that they occur "within the skin" and are elicited by prior stimuli rather than controlled by stimuli occurring after the behavior (see Table 1 for further comparisons of operant and classical conditioning). Classical conditioning concerns how stimuli come to control such involuntary or instinctive behavior (e.g., salivation, the startle response, heart rate) through their relationship with other stimuli which elicit such responses.

As illustrated in Fig. 2, classical conditioning is the process by which a neutral stimulus comes to elicit a conditioned response. A neutral stimulus is one with which the person of interest has had no prior learning, and to which he or she has no unique instinctive response. For example, to a toddler, the sight of a small black-and-yellow striped flying insect might be a neutral stimulus. As with most new stimuli appearing in his environment, before conditioning he would respond to it with an orienting response (e.g., looking toward it, engaging in exploratory visual scanning). Before conditioning, the child was likely born with an unconditioned (instinctive) fear response to painful stimuli such as bee venom under the skin. If the toddler explores the sight of the bee

Table 1
Comparing the components of classical and operant conditioning

Component	Classical	Operant
Behavior	Elicited "involuntary", instinctive, or reflexive behavior which mostly occurs "within the skin": e.g., salivation, accelerated heart rate, flinching	Emitted "voluntary", goal-oriented, motoric behavior which operates on the external environment: e.g., running, talking, writing
Physiology	Primarily involves autonomic nervous system's regulation of smooth muscles and glands	Involves somatic nervous system's operation of skeletal muscles
Focus	Focus on stimuli	Focus on response and its consequences
Direction of control	Prior (conditioned) stimuli control behavior (conditioned responses)	Subsequent stimuli (reinforcers or punishers) control behavior

(neutral stimulus) too vigorously, conditioning might occur, with the sight of the bee paired with the unconditioned stimulus of the bee's venom under the skin. During conditioning the child will exhibit the unconditioned response of crying, having an increased heart rate, etc. After conditioning, the now conditioned stimulus, the sight of the bee, will have gained the power to elicit a conditioned response (e.g., crying) similar to the unconditioned response. Thus, the child will cry at the sight of a bee.

A full description of the state of theory and research on the relationship between classical and operant conditioning is beyond the scope of this article. (See Allan, 1998; Forsyth & Eifert, 1998; and Schwartz & Gamzu, 1977, for such discussion.) However, the reader may have noted parallels between the pairing processes involved in creating secondary reinforcers and conditioned stimuli. Thus, classical conditioning may shed some light on how stimuli are established as reinforcers or punishers. In addition, the conditioning of a fear stimulus may precede the escape and avoidance behavior commonly seen in anxiety disorders. In turn, operant avoidance may prevent respondent extinction, the process whereby a conditioned stimulus (e.g., the smell of stagnant water for a jungle combat

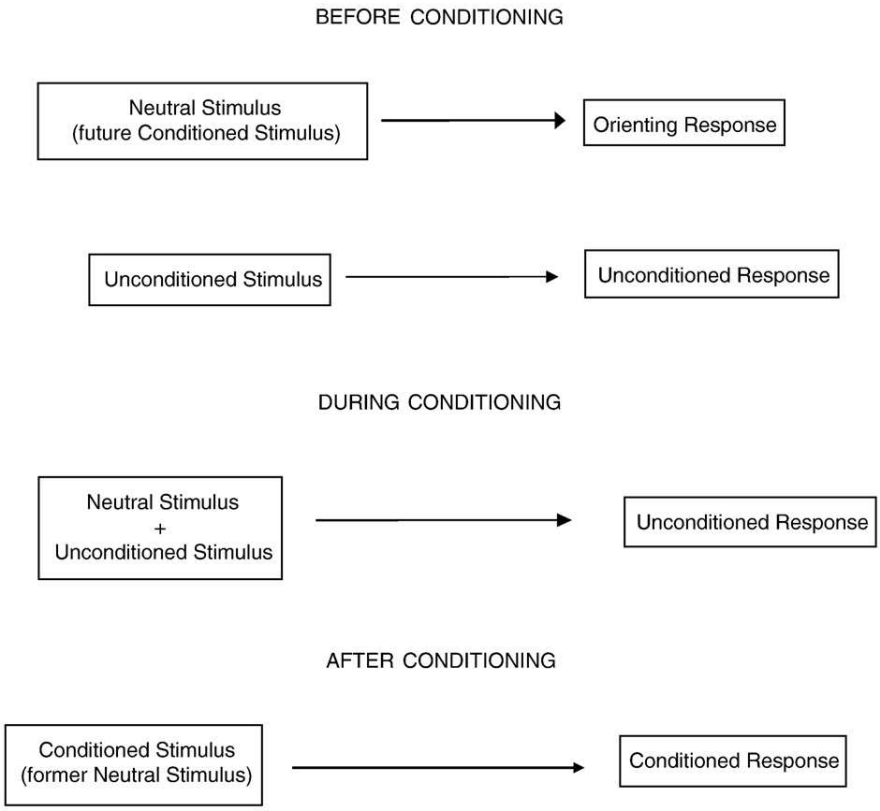

Figure 2. Classical conditioning.

veteran), through repeated or prolonged presentation in the absence of an unconditioned stimulus (a gory corpse), loses its power to elicit a conditioned response (fear arousal such as rapid heartbeat, sweating, etc.).

Types of Functional Analysis

One might describe three types of functional analysis seen in behavioral practice (Martin & Pear, 1999). These differ in their level of rigor and practicality in practice. All three types form hypotheses about the controlling antecedents and consequences of the behavior of interest, devise an intervention based on these hypotheses, then implement the intervention to test the hypotheses. In "informant-based assessment"[3] the practitioner collects information from the client or others familiar with his/her behavior using questionnaires (e.g., Sobell, Toneatto, & Sobell, 1994), interviews, or self-monitoring. In "observational assessment" the practitioner directly observes the behavior of interest. Using the data collected, informant-based or observational assessments then test the hypotheses they generate, employing an A-B design, where A represents the baseline (preexisting) strength of the behavior and B is the treatment or intervention phase strength of the behavior. The gold standard is the "experimental functional analysis." In this approach the practitioner may gather information and formulate hypotheses about the controlling antecedents and consequences of the behavior of interest, similar to informant and observational methods. However, he or she then uses an experimental quality within-participant design such as multiple baseline (applying the intervention sequentially to several behaviors or in several settings) or A-B-A-B ("reversal" or return to baseline phase, replicating the intervention effect) to either confirm or reject the hypotheses. (See Blampied, 1999; Hersen, 1985; and Kazdin, 1982, for further discussion of within-participant designs.)

Target Behavior Selection and the Context of Functional Analysis

As apparent above, the behavior of interest, or target behavior, is the focal point for functional analysis. Yet how and why practitioners and/or clients choose a particular behavior to target is mostly neglected in writing on the topic, and in practice. This fundamental conceptual gap in functional analysis may be the primary reason that the reliability of target behavior selection is low (Hay, Hay, Angle, & Nelson, 1979). A related implication of this gap is what Haynes et al. (1997) suggest may be "[t]he most serious threat to a functional analysis": "inadequate content validity—a model may fail to include important ... behavior problems or may include irrelevant variables" (p. 337).

Without a standard for judging which of the client's behaviors are relevant and important to a behavior change effort, the determinants of target behavior selection remain implicit, arbitrary, and/or inconsistent with the functional perspective (i.e., the focus on the relationship between behavior and environment) of functional analysis. This leaves open the possibility that clinicians will deem a behavior change effort successful when it has changed irrelevant or unimportant behaviors. Moreover, target behavior selection matters because introducing a new client behavior into his or her environment creates consequences. Arbitrarily or erratically choosing target behaviors would seem to increase the risk of unintended consequences harmful to the client. For example, teaching a client how to give negative feedback to others may actually damage rather than improve his or her relationships if it increases the frequency of criticizing others. The lack of a targeting standard also creates a conceptual disconnection between target behavior selection and the rest of functional analysis. For example, if we performed a functional analysis of clinician and client behavior in *selecting* a particular target behavior, it might reveal avoidance by both parties (e.g., the practitioner might not target behaviors with which he or she has less experience) or the influence of short-term reinforcers such as approval from each other.

In behavior therapy practice with adults, typically the client's presenting complaint or his or her *DSM-IV* (American Psychiatric Association, 1994) diagnosis determine the target behaviors. However, many factors shape the client's presenting complaint, including emotional arousal associated with discussing certain behaviors and the client's ability to observe his or her own behavior. Moreover, there are several problems with *DSM-IV* symptom remission as a standard for the success of a behavior change effort. First, nomothetic diagnostic criteria may not adequately represent what is important to an individual client. Second, and more problematic, symptom remission represents a medical model standard for success in a behavior change effort. This is inconsistent with functional analysis (cf. Kazdin, 1978; Wolpe, 1989).

In their approach to functional analysis, Haynes et al. (1997) have clients rate the importance of various behaviors identified by the client or practitioner. This still begs the question of the basis of those ratings. Haynes, Richard, and Kubany (1995) maintain that content validity in behavioral assessment is judged according to higher-order variables than the target behaviors themselves. Such higher-order variables are determined at least in part by clarifying what confers importance upon a

[3] Martin and Pear (1999) use the term "questionnaire assessment" for this type of analysis. However, the current author finds this term overly restrictive.

particular behavior change targeted by the clinician or requested by the client (cf. Haynes et al., 1997).

Perhaps the functional perspective, which serves behavioral practitioners well in identifying other relevant variables, can suggest higher-order variables that might confer importance upon a behavior. A principle in behavior therapy has been that the most important aspect of behavior is its function, not its topography (appearance). For example, in early studies of rat bar pressing behavior, it was engagement of the bar mechanism that dispensed food which defined bar pressing, not whether the rat pressed with front, hind, left, or right foot (or nose, for that matter). Similarly, in human dating behavior, there are many ways to ask another person out, but what matters is if the person says "yes." If the consequences of a behavior are central to defining it, a short conceptual leap leads to the assertion that consequences confer importance upon the behavior. It is food that confers importance on the rat's bar pressing, and yeses that confer importance on initiation behaviors in dating. Literally, these behaviors exist and persist because of their consequences.

How might this functional perspective apply to target behavior selection? In adult behavior therapy practice, those client behaviors with the most frequent and/or significant undesired consequences often get priority as targets. While avoiding undesired consequences can be important, there are several potential limitations of this approach. First, it may reinforce avoidance patterns exhibited by the client. Take the example of a client who has problematic conflict with his co-workers because he frequently interrupts and talks over them. This client may prioritize avoiding conflict and criticism rather than managing and learning from these to improve work relationships. Second, behaviors with undesired consequences are best changed by replacing them with behaviors expected to have desired consequences (i.e., differential reinforcement of other or incompatible behaviors; see Martin & Pear, 1999). Returning to the client with workplace conflict, increasing behaviors (e.g., active listening, complimenting) likely to meet with the *desired* consequences of approval and cooperation from his co-workers has a better chance of success than simply reducing or eliminating his interrupting and talking over. One might then describe effective behavior therapy for interpersonal problems as teaching the client to perform behaviors that will serve, in particular contexts, as discriminative stimuli for desired reinforcing responses from others. Thus, clarifying the desired consequences of client behavior change identifies important target behaviors that might lead to those consequences, and can increase the likelihood of change effort success.

Unfortunately, clients may be trapped by short-term desired consequences that reinforce behavior incompatible with their long-term success and happiness. This is a common conceptualization of client presenting problems. For example, while drug abuse may lead to intense desired short-term consequences (e.g., euphoric sensations), these consequences powerfully reinforce drug-seeking behavior which often leads to long-term aversive financial and relationship consequences. Similarly, meeting numerous partners to engage in casual sex may result in intense desired short-term consequences (e.g., sexual orgasms, flirtation from others) but often leads to aversive long-term problems (e.g., sexually transmitted diseases, unwanted pregnancies, delay in finding a committed long-term relationship). Thus, clarifying the *long-term* desired consequences of behavior change identifies important target behaviors that can lead to more profound and sustainable change.

A variety of behavioral authors (e.g., Evans, 1997; Hawkins, 1986; Hayes, Strosahl, & Wilson, 1999; Kanfer & Schefft, 1988; Yoman & Edelstein, 1994) have advocated for targeting behaviors in the context of their desired long-term consequences. Similarly, Rosen and Proctor (1981) devised the term "ultimate outcome" to describe "sufficient conditions for treatment to be terminated and considered a success" (p. 419). These targeting approaches take into account the frequent role of short-term consequences in behavior problems and of long-term consequences in defining human successes (e.g., happy marriage, career advancement). A regular practice of defining long-term consequences may function as rule-governed behavior for both client and practitioner, in that it creates a verbal description of long-term contingencies that may decrease the control that short term consequences have over their behavior (see Malott, 1989).

Yoman and Edelstein (1994) refined Rosen and Proctor's (1981) "ultimate outcome" from a behavioral perspective to refer to the valued (usually long-term) results clients obtain from change in the behavior of interest. Yoman and Edelstein encouraged preestablished ultimate outcomes as the touchstone for determining the importance of potential target behaviors. They described two types of ultimate outcomes commonly encountered in behavior therapy: interpersonal and intrapersonal. Interpersonal ultimate outcomes involve the reaction to a client's behavior change by a key person in the client's life (e.g., a prospective friend more frequently seeking social contact with the client). Intrapersonal ultimate outcomes involve the client's own reaction (usually a private event or involuntary response) to his or her behavior change (e.g., weight loss, increased life satisfaction).

Several authors (Hayes et al., 1999; Yoman & Edelstein, 1994) equate long-term consequences with values. Focusing on ultimate outcomes that reflect the best interests and values of the client fulfills important ethical obligations of the helping professions (e.g., American Psycho-

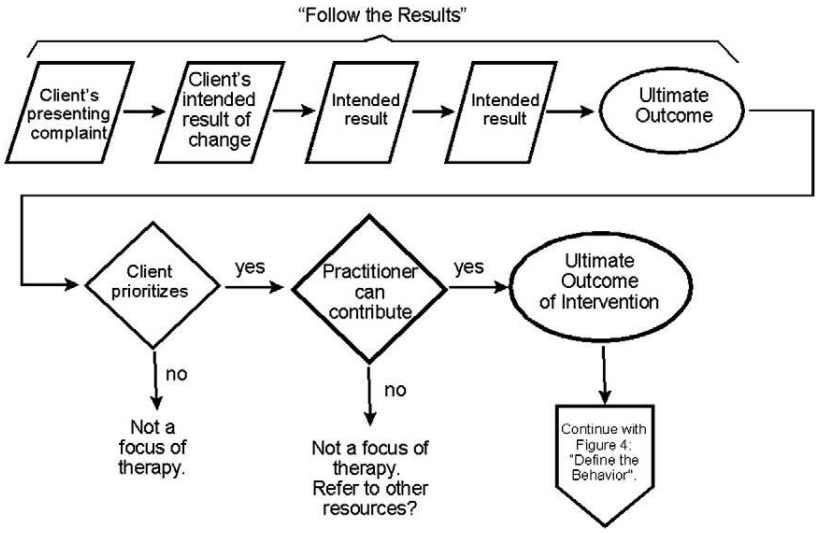

Figure 3. Define ultimate outcomes.

logical Association, 2002; National Association of Social Workers, 1999). Identifying ultimate outcomes of behavior change, therefore, incorporates into functional analysis the prevalent practice of values clarification in professional helping relationships (see Kanfer & Schefft, 1988). While professionals have no empirical basis for recommending which values clients should choose, they can advise clients which behaviors will tend to further those values. For example, our current state of knowledge allows us to state with some confidence which behaviors contribute to marital satisfaction, but not whether a client should desire marital satisfaction, even though that choice may lead to a longer life (which the client may or may not desire). Similarly, we have some information on which behaviors a client may want to master to establish friendships, but not whether the client should desire friends who are fun, friends who are intelligent, friends who share his or her commitment to a particular social cause, or none of the above.

As discussed below, defining ultimate outcomes of intervention may guide not only selection of target behaviors, but specification of their optimal topography, frequency, intensity, and timing. Defining with the client these hoped for consequences of the new behaviors is a helpful starting point for functional analysis.

Functional Diagnoses

Hypotheses generated by functional analysis can be termed "functional diagnoses." Functional diagnoses provide names for the types of functional relationships hypotheses describe in detail. (See Ferster, 1965; Hawkins, 1986; Martin & Pear, 1999; and Tryon, 1996, for overviews of similar classifications of functional relationships.) Figs. 3 through 9 together depict a flow chart for functional analysis, with functional diagnoses appearing inside ellipses in each figure. After defining ultimate outcomes and the behavior of interest, the practitioner follows the flow chart in these figures (often through an increasingly complex series of functional diagnoses) to a specific behavioral intervention indicated by the functional analysis. Interventions[4] appear in rectangles on the right-hand side of each figure in the flow chart. As suggested above, the eventual effectiveness of the intervention indicated provides evidence to confirm or disconfirm the functional diagnosis (i.e., to convert the diagnosis from "provisional" to "firm" or "final").

Functional Analysis Step by Step

There is little consensus in the field as to how to integrate the above approaches into a reliable, valid functional analysis. This may in part contribute to the unreliability of functional diagnosis in practice (see Alberts, Edelstein, Yoman, & Breitenstein, 1989; Felton & Nelson, 1984). The protocol below may both assist with more reliable functional diagnosis (see Cone, 1997) and serve as a point of departure for functional analysis tailored to individual clients and settings.

Step 1: Define the Valued Long-term Consequences (Ultimate Outcomes) of Behavior Change

Given that there is no established procedure in functional analysis for defining ultimate outcomes with a

[4] Description of interventions is beyond the scope of this article. For such description, the reader is referred to Martin and Pear (1999) and Plaud and Eifert (1998).

client, a suggested interviewing technique of "follow the results" is described below.[5] This technique leads the client from anticipated desired short-term consequences of behavior change to valued long-term consequences or ultimate outcomes (see Fig. 3).

Functional analysis can begin by the practitioner asking the client to describe his or her hoped-for results of therapy. After each client statement of intended results the practitioner repeats the question, "What are the intended results of that?", or something functionally equivalent, until the client states an ultimate outcome. Arrival at an ultimate outcome is usually signaled by the client stating that the intended result of the previous consequence (i.e., the ultimate outcome) is something akin to happiness, life satisfaction, or making the world a better place. Here is an example of how the interview might go:

PRACTITIONER: What results do you hope for from therapy?

CLIENT: I want to be more assertive.

PRACTITIONER: What benefit do you anticipate from being more assertive?

CLIENT: My co-workers won't push me around so much.

PRACTITIONER: And what would result from that?

CLIENT: My boss might use some of my ideas once in a while.

PRACTITIONER: And what would be the benefit of that?

CLIENT: He might see that I have some value to the company.

PRACTITIONER: And what would be the benefit of that?

CLIENT: I might get that raise I've been waiting for.

PRACTITIONER: And what would be the benefit of that?

CLIENT: I could afford to move to a better neighborhood.

PRACTITIONER: And what result do you hope for from moving?

CLIENT: I don't know. Life would just be better in more attractive surroundings.

Once the client makes a general statement of a prospective ultimate outcome, the practitioner can define the ultimate outcome in behavioral measurable terms. In the example above, the ultimate outcome might be stated, "The owner of a home in a neighborhood with at least three young couples, one park, and a below-average crime rate will sign over the title to the client within 12 months."

Further examples of ultimate outcomes follow. A client with obsessive-compulsive hand washing might become interested in decreasing the frequency of this target behavior because the time it takes away from work tasks threatens her ultimate outcome of her boss retaining her with satisfactory performance evaluations in her job as a restaurant hostess. Alternatively, a practitioner for a husband coming to therapy for marital problems might become interested in the target behavior of emotional validating because increasing these behaviors is likely to contribute to productive problem discussion by the client's wife. In turn, engagement in productive problem-solving discussion by both partners might result in ultimate outcomes such as resolution of specific marital problems (e.g., conflicts over budgeting), availability of money for family needs, and increased marital satisfaction (e.g., as measured by the Dyadic Adjustment Scale). Defining the ultimate outcome may suggest related target behaviors to accelerate (e.g., requesting a meeting with one's boss).

Thus, following the results will uncover chains of behaviors and results for discussion by the client and practitioner. These may include undesired consequences to eliminate, desired consequences to pursue, and interpersonal or intrapersonal ultimate outcomes. The client's role is to choose/prioritize which of these he or she would like as the focus of therapy. The practitioner's role is to lend his or her expertise in identifying to which results the practitioner's skills are likely to contribute (i.e., the extent to which the practitioner is educated and experienced in interventions for identifying, shaping, and reinforcing behaviors instrumental to that ultimate outcome). The practitioner's job is also to be vigilant for avoidance and short-term reinforcement as obstacles to the client's pursuit of long-term desired consequences. This includes discussing the benefits of long-term desired consequences as a focus for the treatment plan.

In this manner, the practitioner can set the stage for functional analysis by clarifying with the client the valued ends toward which behavior change will be the means. The practitioner can then examine the relationships between these ultimate outcomes and prospective target behaviors.

Step 2: Define the Behavior of Interest

Defining the valued long-term consequences of behavior change informs the process of defining the behavior

[5] One might also integrate into functional analysis the alternate methods of identifying desired long-term consequences suggested in Quality of Life Therapy (Frisch, 2006) and Acceptance and Commitment Therapy (Hayes et al., 1999).

of interest or target behavior in observable measurable terms (see Fig. 4). Defining the target behavior begins with a discussion between client and practitioner about which behaviors are instrumental in the client's living environment in attainment of a defined ultimate outcome. From that list of behaviors, target behaviors will be those which the client has difficulty performing with a frequency, intensity, duration, etc., thought necessary for ultimate outcome attainment. For example, with the above ultimate outcome of obtaining a home in a better neighborhood, the practitioner might explore with the client other behaviors that might contribute to that result, such as applying for a job with a different company. If the client maintains his interest in working for the same company, the practitioner might also explore alternatives to attaining some of the lower-level results, such as the boss acknowledging his value to the company (e.g., client might ask his boss for a discussion of his performance in which he presents his accomplishments, or ask his boss for a one-on-one meeting in which the client presents his ideas). Discussion and functional analysis of obstacles to these alternative strategies might identify behavioral excesses or deficits that hold the client back in attaining several desired results. Ongoing monitoring of the context, frequency, and consequences of the client's performance of these behaviors might help further refine targets for intervention.

Defining the behavior of interest makes more likely the collection of reliable data regarding the behavior. In the hand-washing example, hand washing might be defined as applying water, soap, or another cleansing product to the hands. Because washing is a motoric behavior (involving muscles in the hands and arms) that has an impact on the external environment (removing dirt and oils from the hands), it is diagnosed as an "operant" (see Fig. 4). In the marital example, the "emotionally validating behaviors" referenced above can be defined to include (1) "summary of partner's emotions and partner's stated reasons for them, confirmed by the partner as accurate" and (2) "statement that the partner's emotions are understandable, given the circumstances," both stated using an empathic vocal tone. Defining the behavior of interest allows the practitioner to begin the process of functional diagnosis. Fig. 4 contains the starting point for functional diagnosis, classifying the topography of the behavior. Because validating is a motoric behavior (involving muscles in the tongue, throat, and jaw) that affects the external environment (by creating sound waves which cause vibrations in the structures of the listener's inner ear), it is diagnosed as an "operant".

Step 3: Collect Data from Informants, and Through Direct Observation, on the Behavior of Interest, and Its Antecedents and Consequences

Self-monitoring, and/or direct observation during a job site visit by the practitioner, might establish a baseline frequency of the hand-washing behavior as well as revealing its antecedents and consequences. To proceed

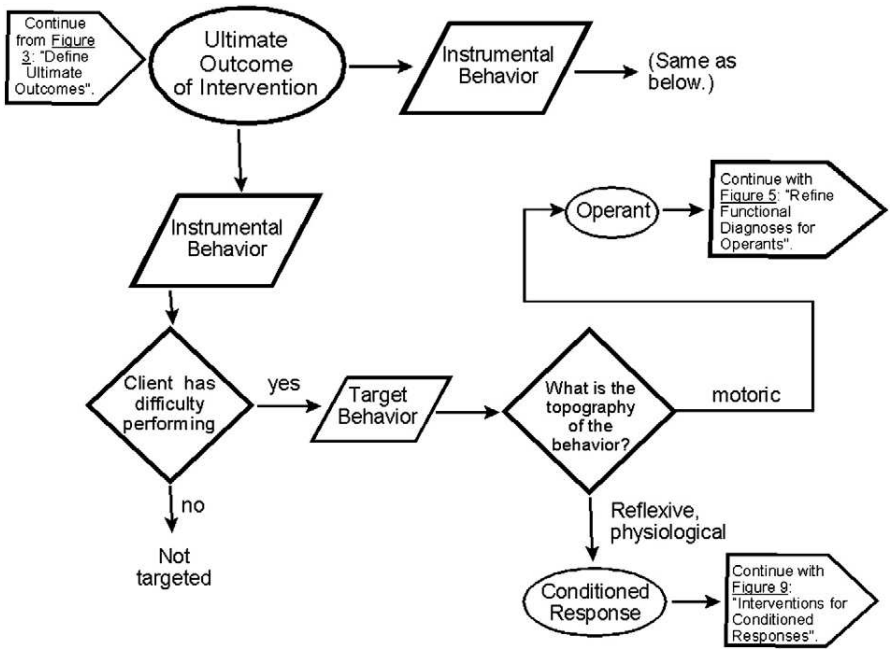

Figure 4. Define the behavior of interest. *Note*: Decisional diamonds contain functional assessment questions. Ellipses contain functional diagnoses.

with the example of emotionally validating behaviors in marital therapy, the practitioner might determine the frequency of the behavior of interest and its antecedents and consequences by having the husband self-monitor validating at home or having his wife complete a behavior checklist on his validating. Alternatively, the practitioner might observe and record the frequency of validating behaviors and their antecedents and consequences in therapy sessions or in an unstructured problem discussion (cf. Jacobson & Margolin, 1979).

Step 4: Formulate Provisional Functional Diagnoses (Hypotheses) Regarding the Behavior of Interest

Collection of data in Step 3 enables further refinement of functional diagnoses. In the hand-washing example, the data collected above would likely reveal that the behavior is too strong to ensure the client's retention of her job; thus, it is a behavioral excess (see Fig. 5). Observations and discussions with the couple in the marital example may suggest that validating is occurring too infrequently to enable attainment of the couple's ultimate outcomes described above (e.g., once a week, when the couple discusses problems several times a week). Thus, validating is too weak and constitutes a behavioral deficit (see Fig. 5).

Step 5: Refine Provisional Functional Diagnoses Based on Further Data Collection

Fig. 5 directs the practitioner working with the client's hand washing to Fig. 6: Functional Diagnoses and Interventions Involving Consequences and Operant Behavior Excesses, given that hand washing has been established as an operant behavioral excess. The first decisional diamond in that figure addresses whether the behavior interferes with ultimate outcome attainment only under specific stimulus conditions. Let us say the practitioner answers this question affirmatively because the client describes the hand washing as a problem only at work, and hand washing in moderation is a healthful part of personal hygiene and job performance. Fig. 6 then directs the practitioner to Fig. 7: Functional Diagnoses Involving Stimulus Control of Operant Behavior. Fig. 7 suggests that operant behavioral excesses are a possible case of dysfunctional stimulus control.

Continuing the marital case example from the functional diagnosis of behavioral deficit in Fig. 5, the practitioner might ask the husband and his wife if he has ever validated her emotional expressions, or simply ask him to do so in a session and see if he is able. For example, the husband may have actually mastered validating in a past marital workshop the couple attended, but he has stopped

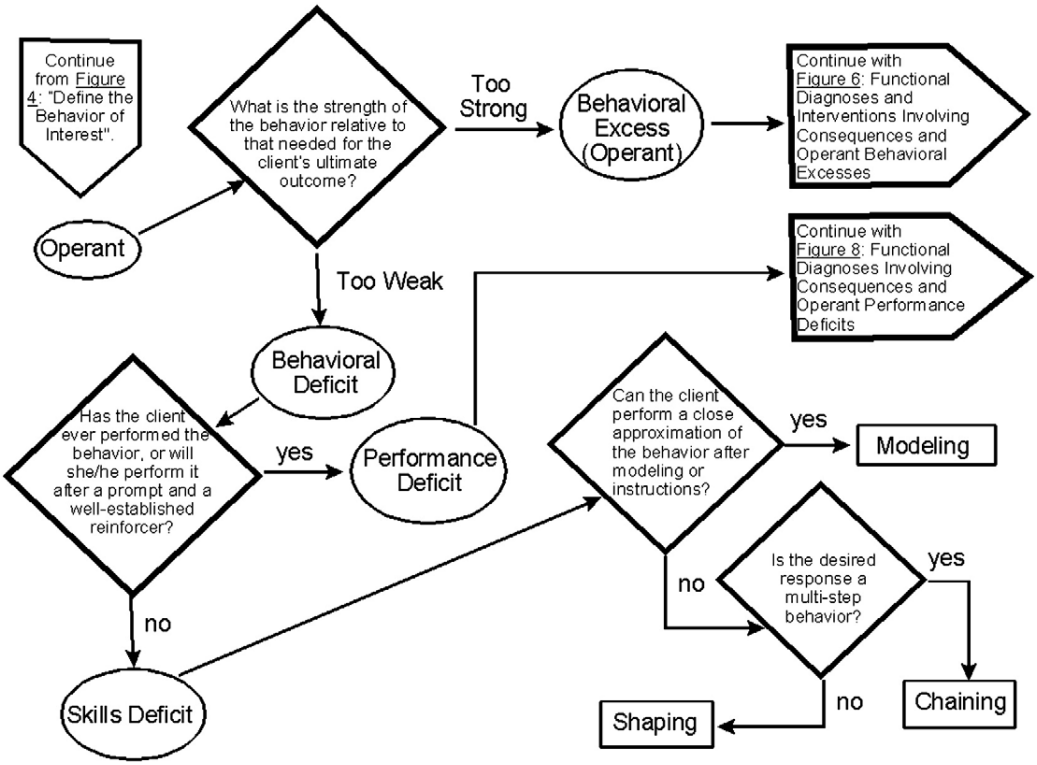

Figure 5. Refine functional diagnoses for operants. *Note*: Decisional diamonds contain functional assessment questions. Ellipses contain functional diagnoses. Rectangles contain interventions.

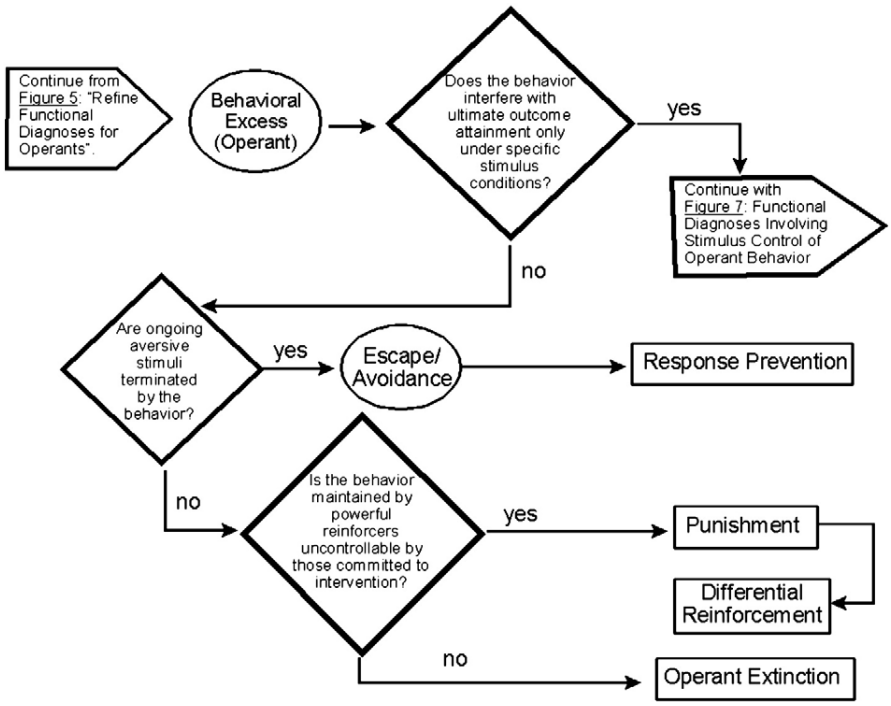

Figure 6. Functional diagnoses and interventions involving consequences and operant behavioral excesses. *Note*: Decisional diamonds contain functional assessment questions. Ellipses contain functional diagnoses. Rectangles contain interventions.

validating since then. This would refine the diagnosis of validating to a performance deficit (see Fig. 5), from which the flow chart directs the practitioner to Fig. 8: Functional Diagnoses Involving Consequences and Operant Performance Deficits. Continuing to refine the diagnosis of performance deficit in Fig. 8, the flow chart indicates two

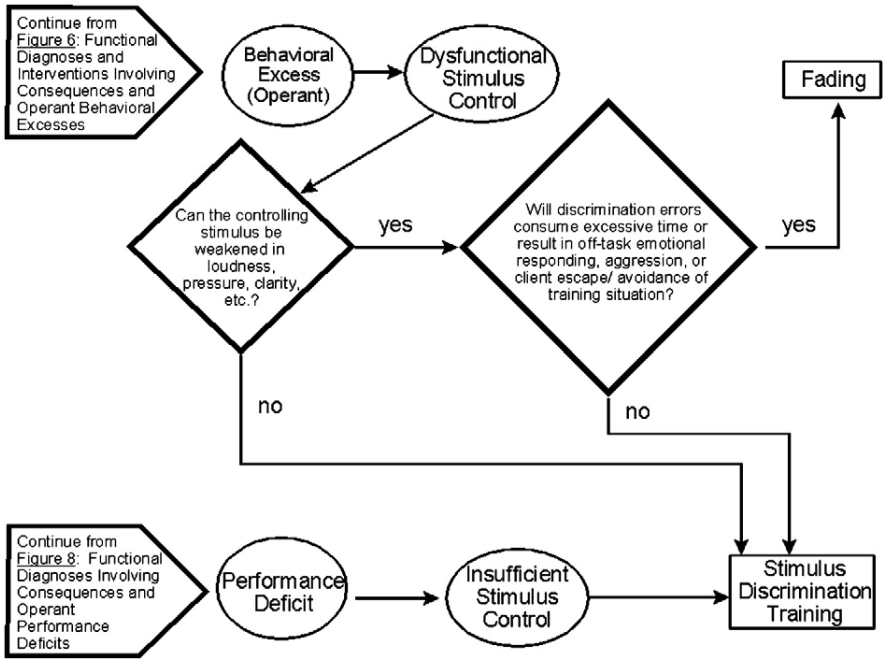

Figure 7. Functional diagnoses and interventions involving stimulus control of operant behavior. *Note*: Decisional diamonds contain functional assessment questions. Ellipses contain functional diagnoses. Rectangles contain interventions.

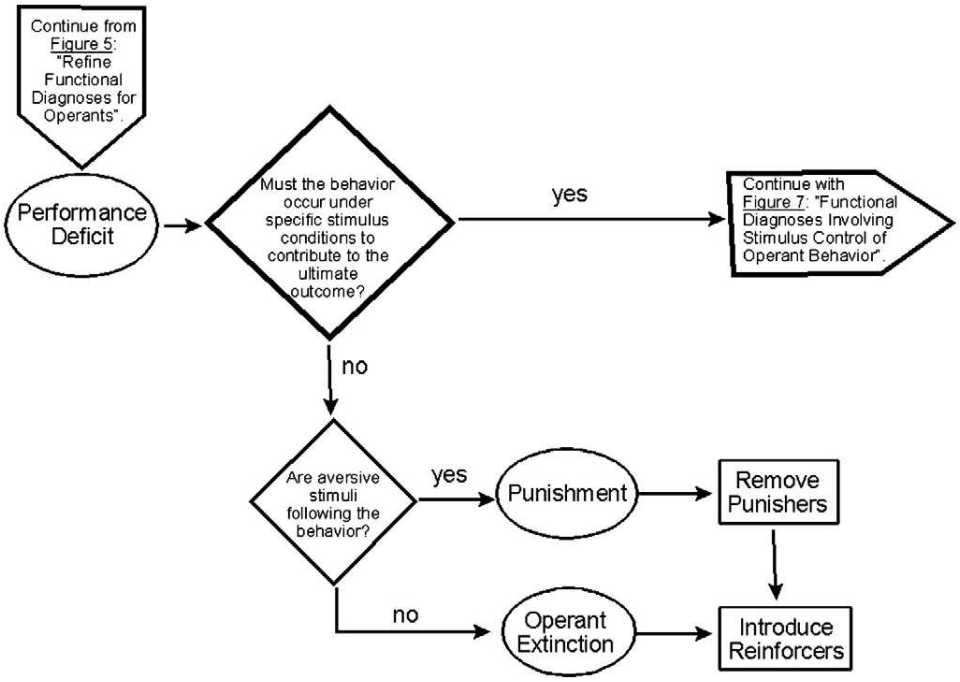

Figure 8. Functional diagnoses and interventions involving consequences and operant performance deficits. *Note*: Decisional diamonds contain functional assessment questions. Ellipses contain functional diagnoses. Rectangles contain interventions.

questions to answer about the behavior. The first question is: "Must the behavior occur under specific stimulus conditions to contribute to the ultimate outcome?" With no research or case data available to answer this question, the practitioner may parsimoniously answer "no." This would direct the practitioner to the second question in the flow chart, "Are aversive stimuli following the behavior?" Perhaps self-monitoring by the husband helps him and the practitioner discover that, when he validates, his wife proceeds with a long monologue about how she feels on many topics unrelated to the problem at hand. The husband feels frustrated with this, both because the problem does not get solved and because he gets little or no time to express his opinion about the problem. The practitioner then hypothesizes that the wife's monologues punish the husband's validating: the functional diagnosis is punishment (see Fig. 8). Note that the specific punisher here may be *withdrawal* of opportunities for the husband to express himself and solve problems (i.e., the wife's cessation of pauses in speech and/or responses to the husband's attempts to speak, as opposed to *presentation* of her monologues per se), a case of negative punishment or response cost (see Fig. 1).

Step 6: Collect Data as Needed to Indicate a Specific Intervention

Self-monitoring reveals that, while the sensation of a doorknob touching her hand is an antecedent to the client's hand washing, it often follows mere thoughts about germs when there has been no doorknob touching. Thus, in response to the next question in Fig. 7, it seems that the stimulus cannot be weakened by the practitioner, so stimulus discrimination training is indicated. In the marital example, the diagnosis of performance deficit due to punishment leads directly to two interventions: removal of the punisher and introduction of reinforcers (see Fig. 8).

Step 7: Implement the Indicated Intervention to Confirm or Disconfirm the Functional Diagnosis (Test the Hypothesis)

In the hand-washing case, the practitioner might instruct the client on the recommended stimulus conditions for hand washing (e.g., finishing toilet use, prior to eating or handling food) and have the client monitor the extent to which she washed her hands under only these conditions. The practitioner could test graphic data presentation as a reinforcer for improved discrimination. This procedure might reinforce self-monitoring by the client, which can help her persist in a behavior change effort. Self-monitoring can be gradually faded as natural reinforcers such as improved performance evaluations come to control the behavior.

The practitioner in the marital example would remove the punisher by interrupting the wife's monologues in sessions, coaching the couple to establish cues for ending monologues, and suggesting the wife pause between topics, and teaching her to discriminate her husband's

attempts to speak. An interactive interpretation (cf. Jacobson & Margolin, 1979) to the couple about how the husband's validation is followed by the wife's monologues might prove an effective antecedent to these interventions. The practitioner would introduce reinforcers for the husband's validating by coaching the wife to disclose positive feelings about the validating, then immediately asking the husband for his thoughts and feelings about the problem each time he validates her feelings. (Note that the above process goals and interventions might themselves be subjected to functional analysis to improve the focus and efficiency of the therapy process. See Edelstein & Yoman, 1991; Kohlenberg, Tsai, & Dougher, 1993; Lejuez, Hopko, Levine, Gholkar, & Collins, 2006.)

To confirm or disconfirm the functional diagnosis the practitioner would implement the above interventions and observe (or have the client self-monitor) whether the husband's validating reaches the targeted frequency. Perhaps the practitioner would discover that validating reached its targeted frequency, but then did not maintain at that level.

Step 8: Recycle Through Steps 4 to 7 as Needed Until Discovery of an Effective Intervention

In the hand-washing example, the practitioner would recycle through Steps 4 to 7 to cover the other direction indicated for operant behavioral excess in Fig. 6. This concerns whether ongoing aversive stimuli are terminated by the behavior. The client may report that hand washing terminates various physiological signs of anxiety (e.g., sweating palms, rapid heartbeat, restricted breathing). This would identify hand washing as escape/avoidance. The practitioner would intervene with a response prevention protocol to break this cycle of reinforcement of excessive hand washing.

In the example of the husband's validating not maintaining over time, the practitioner might examine data from the intervention phase of marital therapy and discover that the wife was responding in a sarcastic vocal tone to some of the husband's validating statements. The husband in turn eventually decreased the overall frequency of those statements. The functional diagnosis of operant performance deficit due to punishment would likely remain, but the practitioner might revisit her decision to answer negatively during Step 5 the first question for performance deficit in Fig. 8: "Must the behavior occur under specific stimulus conditions to contribute to the ultimate outcome?" Exploration may reveal that the wife responds to the husband's validating with a sarcastic tone when the couple discusses a nonproblem situation and the wife discloses milder or positive emotions. Thus the answer to the question may well be "yes," validating only contributes to ultimate outcome attainment for this couple (and the wife only reinforces it) when it happens in the context of problem discussions and strong negative emotional expressions.

To continue to refine the functional diagnosis for the validating, given this situational specificity, the flow chart then directs the practitioner to Fig. 7: Functional Diagnoses Involving Stimulus Control of Operant Behavior. Fig. 7 indicates insufficient stimulus control as the functional diagnosis when there are antecedent problems in performance deficits. The practitioner might then remedy insufficient stimulus control by giving the couple an interactive interpretation of the lack of maintenance of the husband's validating, interrupting session discussions to ask the husband to interpret his wife's nonverbal emotional cues (checking with his wife for accuracy), and teaching the wife to prompt the husband to read her emotional cues (e.g., "What is she feeling right now?") if he is not validating when she expresses a strong emotion. The practitioner can confirm this new diagnosis of insufficient stimulus control if these interventions result in a maintained change in the husband's rate of validating.

Note that the practitioner's job is not finished until he or she also confirms the hypothesis of the instrumentality of the behavior of interest in attaining the ultimate outcome. In the hand-washing example, the practitioner might ask the client to relay her boss's comments about her work, pay raises, etc., and, once hand washing has decreased in frequency and come under stimulus control, determine whether the decrease in hand washing has taken the client's job out of jeopardy. In the marital case the practitioner would do this by assessing marital problem resolution, marital satisfaction, and availability of money for family needs (to the extent that the latter can be affected by the couple's communication) once the targeted frequency of the validating behavior had been reached.

The Continuing Role of Functional Analysis in Behavior Therapy

The above discussion and Figs. 3 through 9 illustrate how functional analysis can link client presenting problems to empirically supported interventions. As a scientific approach to the individual case, it may enable several important improvements to the manualized treatments that comprise the current standard for evidence-based practice. Behavior therapists have historically been champions of specific interventions for specific problems (e.g., Chambless, 2002). Functional analysis is a valuable tool in both demonstrating the effectiveness and increasing the power of those interventions (e.g., Rowan, Holborn, Walker, & Siddiqui, 1984) because it offers more specificity about the individual's problems than does *DSM-IV* diagnosis. For example, a *DSM-IV* diagnosis of major depression may be represented in the individual case as some combination of operant extinction of certain behaviors and avoidance of certain situations (cf. Dimidjian et al., 2006).

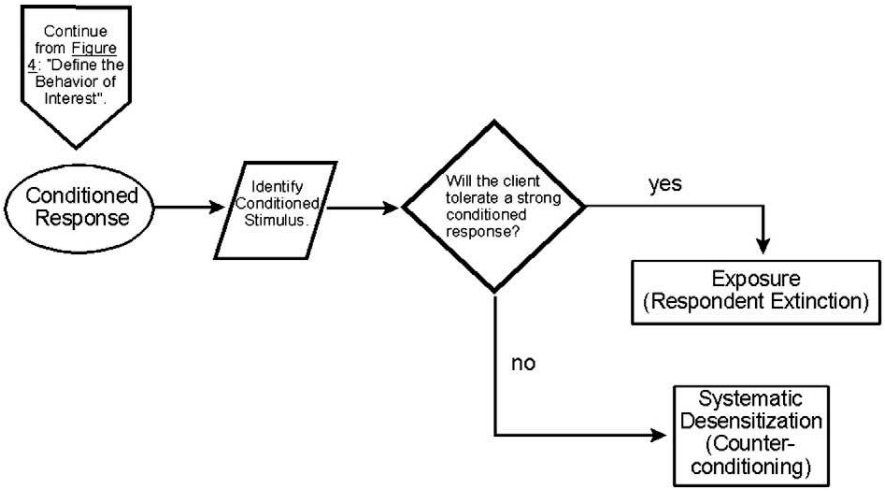

Figure 9. Interventions for conditioned responses. *Note*: Most conditioned responses in behavior therapy are behavioral excesses as depicted in this figure. Conditioned response behavioral deficits such as functional sexual impotence are much less commonly seen and therefore were not depicted in the figure to conserve space. Decisional diamonds contain functional assessment questions. Ellipses contain functional diagnoses. Rectangles contain interventions.

Functional analysis is based on the assumption that causal factors in the client's problems are contextual and idiosyncratic, and only partially held in common with a large group of other individuals with whom he or she shares a diagnosis. In fact, there may be no evidence for the effectiveness of a manualized treatment for as many as 83% of clients whose primary diagnosis would seem to indicate the treatment. Ruscio and Holohan (2006) report that about two-thirds of potential participants are excluded from psychotherapy outcome studies because such problems as substance abuse or physical illness accompany their primary diagnosis. Moreover, among those *not* excluded from outcome studies of depression, for example, "only about half of patients respond to any given treatment" (Hollon, Thase, & Markowitz, 2002, p. 70). This brings into question the degree to which the causal models and assessment targets suggested in group research apply to the individual client, and raises the possibility of greater success with individualized approaches based on functional analysis (cf. Haynes et al., 1997). For example, functional analysis may help the practitioner discover how to disentangle complex problems, improve intervention acceptability, decrease dropout, and help nonresponders respond. Moreover, it would seem an invaluable tool for maintaining a scientific approach to clinical phenomena for which no evidence-based assessment or intervention methods exist.

The advantages of functional analysis are grounded in its defining qualities. For example, in contrast to cognitive methods of assessment, functional analysis focuses on observable behavior change, which not only facilitates maintenance of a scientific approach, it directs the practitioner's efforts where they arguably make the most difference. In the hand washing example above, a cognitive approach would identify "what if" thoughts, perhaps about contamination, and then core beliefs which supposedly underlie them. A cognitive intervention would then guide the client to dispute these. However, there is much stronger evidence for exposure with response prevention for such a behavior pattern, the intervention to which functional analysis led. In contrast to social learning approaches to assessment, which rely largely on role-played simulation of life situations to promote skill acquisition, functional analysis focuses on naturalistic reinforcers for actual performance of a behavior in a context where it is likely to be effective. In the case of the husband's validating, a social learning approach might suggest repeated rehearsal with his wife in session or in at-home communication sessions, to increase mastery of the validating response. This approach might still overlook the differences between the arbitrary rehearsal situations and the real-life situations in which the husband is called upon to validate. Moreover, it does not carefully assess the real-life consequences of validating as does functional analysis, and thus may treat a performance deficit as a skills deficit.

Functional analysis has also been described by several authors (e.g., Edelstein & Yoman, 1991; Kohlenberg et al., 1993; Lejuez et al., 2006) as a tool for understanding and enhancing the therapeutic alliance. A common analytical base may help integrate such work with interventions for specific target behaviors. While cognitive strategies for analyzing and enhancing the therapeutic alliance have been identified, Castonguay, Goldfried, Wiser, Raue, and Hayes (1996) found that treating therapeutic alliance strains as "a manifestation of the client's distorted thoughts" led to further alliance strains. The success of

several therapeutic systems utilizing a functional analytic perspective on the alliance (see Lejuez et al., 2006) suggests a focus on contextual factors in the therapeutic relationship (e.g., to which client behaviors the therapist attends and responds) may hold more promise for advancing this important aspect of psychotherapy.

When targeted behavior change occurs, the work of the practitioner and client may not be complete. For example, Hollon et al. (2002) report that only a third of participants in depression outcome studies remain responders at long-term follow-up. Functional analysis offers a framework for maintaining and transferring to new environments the gains made by specific treatments (see Baer et al., 1968, 1987). It can identify not just current maintaining variables for undesired behavior, but potential maintaining variables for desired behavior. This information can then be used to educate clients on the reciprocal nature of causation, and prepare them and their environments for future challenges. For example, a practitioner suggested that a client who entered therapy to get help with loneliness increase participation in events and organizations that reflected the client's interests, where it was anticipated others were more likely to reinforce the client's initiation and invitations. Weekly discussion of the client's social initiation diary included guiding the client in discriminating encouraging signals from acquaintances, experimenting with timing initiations and invitations, and identifying friendly environments based on successes and failures.

Once researchers establish empirically supported interventions for groups or individuals, organizational contingencies will determine whether those interventions are disseminated. Functional analysis generates valuable strategies at an organizational level (e.g., Krapfl & Gasparotto, 1982) to ensure that practitioners' effective implementation of those strategies is followed by reinforcing consequences in both the short and long-term.

Finally, as a scientific approach to the individual case, functional analysis is a helpful tool for integrating research and practice, which presents untapped opportunities for advancing the science of behavior. Within participant designs provide opportunities for clinicians to produce and publish research, and for research to incorporate more of the concerns of clinical settings.

Functional analysis allows a more fine-grained examination of the effectiveness of treatment manuals with individual cases, and may thus generate hypotheses for improving those manuals for nonresponders. Functional analysis may be the primary guide for practitioners in "uncharted territory", where no evidence-based intervention exists for a client's problems.

Hopefully, further research will improve functional analysis itself. More study is needed to improve content validity of functional analysis and reliability of target behavior selection, two overlapping and fundamental contributors to the utility of functional analysis. Defining the valued long-term consequences of a behavior change effort may help with content validity and target selection reliability, better connect the target selection process with the research upon which functional analysis is founded, shed light on the interrelationships among long-term consequences, and lead to valuable new discoveries about which behaviors further which valued long-term consequences.

While some may believe functional analysis to be outmoded or irrelevant, it remains a key to unlock unique knowledge for behavioral and cognitive-behavioral practitioners and scientists. It is still their most valuable tool for conceptualizing cases, and identifying and demonstrating the active ingredients of interventions with individuals. In sum, functional analysis seems well-suited to answering Paul's (1969) enduring question: "… what treatment, by whom, is most effective for this individual, with that specific problem, under which set of circumstances, and how … ?" (p. 62).

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