



# Functional Analysis of Behavior

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Functional analysis is an approach that guides treatment decisions. This article provides information about the approach, focusing on the theory from which it developed, and its clinical application. This article also introduces some of the well-validated treatments that make use of functional analysis and provides a clinical example of the process.

## GLOSSARY

**conditioned stimulus** A stimulus that acquires some aversive or appetitive psychological functions as a result of respondent conditioning processes.

**discriminative stimulus ( $S^D$ )** A stimulus (or context) that increases the probability of a given response as a result of a history of reinforcement in the presence of that stimulus and extinction in its absence.

**establishing operations (EOs)** Operations that have two primary effects on operant responding. First, EOs make a given response more probable. Second, EOs make a reinforcer associated with that response more effective. For example, if a rat has been reinforced for lever pressing with food, food deprivation would be an EO. The establishing operation has sometimes been referred to as a fourth term in the three-term contingency analysis.

**reinforcing stimulus ( $S^R$ )** A stimulus that follows a response and alters the future probability of that response. Reinforcing stimuli increase the probability of response, and punishing stimuli decrease the future probability of response.

**three-term contingency** A description of the functional relationship between (1) antecedent stimulation, (2) responding, and (3) the consequences produced by that response.

## I. DESCRIPTION OF TREATMENT

Functional analysis is not a treatment per se. Rather, it is an analytic strategy that directs intervention. In the most abstract sense, the term functional analysis is borrowed from mathematics and describes some relationship between variables in which changes in one variable alter the value of another variable. In psychology, functional analysis refers to the exploration of how certain stimuli and responses mutually fluctuate. The process includes monitoring a target behavior over time and manipulating antecedents and consequences methodically to determine the features of the environment that predict and influence the behavior of interest. Although functional analysis has historically been most identified with operant conditioning, operant and respondent conditioning processes do not occur in isolation of one another. Rather, these are densely interrelated conditioning processes. Especially in attempting to understand complex clinical phenomena, functional analysis must include an assessment of both respondent and operant contingencies and their interactions.

Functional analysis in psychotherapy is the link between pretreatment assessment data and the design of individualized treatment plans. Elements of the analysis affect decisions about which variables should be targeted in treatment. Such treatment focuses on the variable or variables whose modification is likely to cause the greatest reduction in the problem behavior and/or increases in behaviors that enhance the client's quality of life. Because certain behaviors are reasonably well correlated, research may guide the functional analysis. For example, if someone reported a fear of panic attacks, research suggests a variety of situations that are likely to be avoided (e.g., shopping malls, buses), and those would be assessed directly. However, because functional analysis is linked to a tradition of examining the effects of antecedent and consequent events on the patterns of behavior in individual subjects, the focus has been on individualized assessment of these variables.

Functional analysis used for treatment purposes involves several steps:

- A. Assessment of problem behaviors, including intensity, frequency, duration, and variability
- B. Assessment of relevant antecedents, including establishing operations, discriminative stimuli, and conditioned and unconditioned aversive and appetitive stimuli
- C. Assessment of consequences, including reinforcing and punishing consequences
- D. Treatment by intervening on identified antecedents and/or consequences.

### A. Assessment of Problem Behavior

Where direct observation of problem behaviors is possible, it is preferable to indirect assessment. However, in the treatment of adult outpatient cases, such direct observation is often impossible or impractical. In such instances, assessment of the problem behavior is accomplished through questions like, "What is going on in your life that concerns you?" Details about the range of the problem can be obtained through questions about affect, overt behaviors, somatic sensations, and thoughts that are related to the problem. Questions that illuminate duration, intensity, and variability might include: "On a scale of 1 to 10, how depressed did you feel?" "How long did that continue?," or "Can you tell me about the worst your problem has ever been and also times when it seemed to improve?" Terms like anxious and depressed are used very loosely in lay vocabulary. For treatment purposes, we want a more particular description of the

problem behavior. We may obtain this by asking questions such as "When you say you feel depressed, what, in particular, does that mean to you?" Examples may be provided based on research demonstrating the co-occurrence of some behaviors. For example, in an interview with a client complaining of depression, we might ask about sleep, mood, and appetite concerns.

### B. Assessment of Antecedents

Questions such as "Has this ever happened at any other time in your life?," "What else is going on when this occurs?," and "Does this same thing happen in different places or at other times?" can be used to assess the antecedents influencing behavior. It may also be useful to ask about situations in which the client's difficulty is least likely to occur, or is least severe. In summary, it is necessary to ask questions that provide the therapist with some sense of the variability in the problem behavior. Identification of most and least problematic contexts can form the basis for hypotheses about relevant discriminative stimuli as well as conditioned appetitive and aversive stimuli.

For example, a client might describe anxiety in social situations that is exacerbated by an evaluative component in the social interaction. In this example, social interaction is the context ( $S^D$ ) in which escape is reinforced by the termination of the aversive stimulus (e.g., the social interaction, aversive thoughts, emotional, and bodily states associated with such interactions). Adding an evaluative component to such an interaction would constitute an establishing operation (EO), because it would alter the probability of escape and the reinforcing value of that escape.

### C. Identification of Consequences

Consequences can sometimes be identified by asking questions such as "What happens after this?" and "How do you feel when this is over?" Sometimes there are social consequences for symptoms. For example, others in the household may pay more attention to the client when the client show signs of depression, or they may temporarily take over household tasks. This sort of consequence can be assessed through questions like "What are the reactions of other people when you get depressed?" Whenever possible behavior, antecedents, and consequences should be assessed using direct observation. When direct observation is not possible, using multiple sources of information, such as family, friends, and co-workers, can be helpful.

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### D. Treatment Process

An intervention is devised based on the functional analysis. Appropriate interventions could be aimed at a variety of components identified in the analysis. Some interventions aim at altering the presence of the actual antecedent and consequent stimuli that maintain the behavior. For example, a heroin addict might be relocated to a setting that had few or no drug dealers. This would result in the removal of both  $S^D$ s (drug dealers) for drug seeking, and heroin, which is the reinforcer for drug seeking. Other interventions are aimed at altering the psychological functions of the antecedents and consequences, rather than their actual presence. The same addict might be given methadone to eliminate the reinforcing properties of the opiates. Opiate deprivation is an EO for drug seeking, because it makes drug seeking more probable and increases the reinforcing properties of opiates. Because methadone blocks abstinence syndrome, it also alters the motivational (EO) effects of opiate deprivation and therefore alters the probability of drug seeking.

Other means of altering the psychological functions of antecedent stimuli might be to reduce or eliminate the effects of appetitive or aversive conditioning. In the earlier social anxiety example, this might involve systematic exposure to social interactions, which would result in lessened fear and avoidance in the presence of social situations. In the addiction example, we might systematically expose the addict to drug cues, thereby reducing the conditioned appetitive functions.

Finally, the problem behavior can be targeted directly by, for example, increasing the probability of some incompatible behavior. Often, these interventions are combined. Thus, in the social anxiety example, the therapist would likely give considerable social reinforcement to the client as the client approached feared social situations. This intervention might result in both strengthening of the approach operant and extinction of conditioned fear. Having been conceptualized in terms of basic behavioral principles, the treatment is implemented, and an assessment of change is made. If the outcome is acceptable, the process is complete. If the outcome is unacceptable, the next step is to recycle to conceptualization stages. More assessment may be needed, or other controlling variables may be manipulated.

These cases consist of relatively simple examples; however, functional analysis need not be limited to a narrow range of behaviors, antecedents, or consequences. Extraordinarily complex human problems can be examined without violating the fundamental pre-

ises of functional analysis. Some of the process will be illustrated with the following case.

### E. Case Example

Mary is a 20-year-old African-American female who was seven months pregnant with her third child at the time of the interview. She was referred for psychological treatment by her gynecologist, who described her as "difficult," "angry," and "indifferent." His immediate concern was her drug use. Excerpts from the initial interview with Mary are used to illustrate assessment components in a functional analysis in an outpatient clinic setting.

Therapist directly assesses problem behavior: Mary, your doctor referred you here, because he was worried about you and your children. It would be good to take a few minutes to talk about this. Help me understand what is going on. First, tell me about the drug use and then we can talk about anything that you think will help me understand what it is like for you. Your doctor tells me that you have been smoking marijuana about once a week, drinking alcohol several times a month; and that you have smoked crack cocaine twice since becoming pregnant.

Client: Yeah, that's about right. So what?

Therapist attempts to get the client to discuss range of the drug problem: So what? You tell me. What does that mean to you?

Client: I don't care.

Therapist continues to assess range: You don't care about your health, or your baby's?

Client: Not really.

Therapist attempting to elicit other problems and prioritize: Wow, that is a pretty powerful statement. Things must be really bad.

Client: Not any different than usual. I have never had a happy day in my whole life. Never. There is nothing for me to live for. I am sad all day.

Therapist attempting to find out about duration and variability: You have never had a happy day, what about a happy moment?

Client: I guess that I have had a few short minutes but I don't really remember them.

Therapist assesses problem severity: Have you ever thought about ending it all, about suicide?

Client: Every day. I think of it every day. I've tried twice by taking a bunch of pills, but it didn't work. My boyfriend killed himself.

Therapist asking about boyfriend's suicide as potentially important antecedent: When did that happen?

Client: Three months ago. His family blames me. We were fighting and talking about breaking up. He told me that he was going to do it. I didn't believe him. I hung up on him, and two hours later I found out he was dead.

Therapist: How did you find out?

Client: His friend walked over to my apartment and told me.

Therapist assesses response to painful antecedent: What did you do?

Client: I took my kids to my mom's and went to get high.

Therapist attempting to clarify response: You got high, how?

Client: I smoked a blunt (marijuana). I drank some beer too, just two. I don't like the taste of alcohol.

Therapist attempting to assess consequences: You don't like the taste but you drink anyway. What does it do for you?

Client: Same thing it does for everybody, helps keep my mind off things.

Therapist assessing consequences: Did it help you keep your mind off your boyfriend's suicide?

Client: For a little while.

Therapist asking about other antecedents: When you are getting high what other things are you trying not to think about?

Client: Men. I hate men.

Therapist clarifying range and context: All men?

Client: All men. My boyfriend was the only halfway decent one that I ever met. They think differently than women. They think backwards. I hate them.

Therapist assessing variability: You say that you hate men; do you feel anything else?

Client: My cousin starting molesting me when I was six. He kept doing it until I moved out. I told my uncle but he did not believe me. I told my stepdad and he didn't believe me. You cannot trust a man. Do we have to talk about them? I wanted a female to talk to so we wouldn't have to talk about them.

Therapist eliciting other problems: I understand that it is very hard to talk about these things. I am only trying to figure out what all of your concerns are. What do you think is the hardest thing for you right now?

Client: Being depressed. I just watch TV all day long. Usually I watch game shows but I am not very good at them.

Therapist asking about context: Is there anytime when you do not feel depressed?

Client: Not really.

Therapist assessing antecedents: Is anyone else around?

Client: My baby. He will be one next week. He is wild sometimes.

Therapist assessing social environment as relevant context: One year olds aren't great to talk to. Do you have any friends?

Client: My mama. That's it. She is the only one who cares about me.

Therapist assessing consequences: Is there anything, besides getting high, that seems to make things better?

Client: Watching television helps a little. Sometimes I clean the house, even if it does not need it. It keeps my mind off stuff.

Therapist asking about context and consequences: What about doing something out of the house, like work or school?

Client: I can't get a job. I can't pay a babysitter. Besides, nobody wants to hire me. I went to college for one semester, after my baby was born. I got mostly As. I got twelve credits, but I cannot go back because it would be too hard with three babies. People tell me that I can't do it.

Therapist clarifying nature of problem: Do you think that you can't do it? You had good grades before and you already had two kids.

Client: I don't know, someday. I have to get them to school first.

Therapist assessing consequences: Sounds frustrating. It sounds like you want to go to school but feel like you can't. What about a job?

Client: I really don't want that.

Therapist clarifying consequences: So, you get out of having to work because you have kids and are pregnant. Is there anything else that these problems get you?

Client: I don't know, maybe.

Therapist assessing consequences: Like what?

Client: My mom helps me out. I like that. I am still a kid, you know.

Therapist: Is there anything else that you have to say that will help me understand things better?

Client: No.

Therapist reasserts interest in understanding client's problems and the need for more assessment: Ok, see you next week. I will keep asking more of these questions to try and get it. Thanks for talking with me.

In this excerpt from an intake interview several potentially important components of the client's problem and its context were revealed (see table 1). From them a tentative case conceptualization can be formulated. As identified by the client's physician, drug use during

TABLE 1  
Components and Treatment Implications of Functional Analysis of Behavior

Antecedents	Behaviors	Consequences
Social isolation	Drug use during pregnancy	Drugs produce positive intoxicating effects
Low levels of physical activity	Depressed mood	Drug use makes temporary avoidance
Hx of sexual abuse & other negative experiences with men	Hopeless thought patterns	of negative cognition and mood possible
Death of boyfriend	Avoidance of negative mood and cognitions using unproductive activity such as drug use, TV	Drug use reduces social isolation
Social punishment for boyfriend's suicide	Generalized avoidance of men	
<i>Potential intervention on antecedents</i>		<i>Potential intervention of consequences</i>
Increase general and especially social activity		Reinforce any increases in general and especially social activity
Exposure-based treatment to cues related to loss of boyfriend – including both external cues as well as associated cognition, emotion, and bodily states		Reinforce client's willingness to engage in exposure-based treatment efforts
Exposure-based treatment with respect to sexual-abuse cues, including both external and interoceptive cues		Antidipsotropic medications to replace reinforcing effects of alcohol with punishing effects (poor choice given client circumstances and problem severity)
Antidepressant medication to alter negative mood states that precipitate maladaptive avoidance		

pregnancy is this young woman's most pressing behavior problem. Relevant antecedents appear to be depressed mood, guilt, boredom, and perhaps relief from decidedly fatalistic thinking. Given the client's circumstances, these are not unexpected reactions. In behavior analytic terms, drug use is maintained by negative reinforcement. That is, aversive mood and thinking are removed as consequences of drug use. In another part of the interview, the client revealed that the instances of drug use were also some of her only social interactions apart from interactions with her mother and children. This further bolsters the notion that drug use is maintained by negative reinforcement. Drug use not only reduces aversive mood and cognition, it also reduces social isolation and increases a general low level of activity.

Intervention on the consequences of drug use is unlikely to be helpful. The reinforcing effects of alcohol could be eliminated by administering an antidipsotropic drug, like antabuse, that would produce a potent punisher for drinking. Given the pregnancy, however, this would be unacceptable. No such pharmacological interventions are available for marijuana or cocaine. In addition, the client would be left with no good alternative strategies to cope with her rather bleak existence and resulting aversive mood states. Intervention on problematic antecedent mood states might include antidepressant drugs, although this pharmacological intervention might

reduce aversive mood states, it would not address the client's impoverished life circumstances.

A more hopeful intervention could focus on increasing the client's general activity level, with a special emphasis on healthy social interactions. Because this client grew up in a very active religious community, the possibility of becoming engaged in social, worship, and volunteer activities with her church could be explored. Reentry into school could also be examined as a possibility. Initially, any increase in physical and/or appropriate social activity ought to be reinforced. Behavioral activation has several advantages. First, behavioral activation has been repeatedly demonstrated to have a positive impact on negative mood and cognition. Second, these activities would be incompatible with drug use. Third, the young woman would likely broaden her social support system. And finally, the resulting social support system might provide reinforcement that could maintain this ongoing stream of healthy behavior.

This client revealed a variety of other difficulties that may bear further exploration and direct treatment. For example, her history of sexual abuse may have precipitated a host of potential difficulties. She may have difficulties with intimate relations and issues of trust with men. Although not revealed in this interview, possible posttraumatic stress disorder symptoms, like sleep disturbance, flashbacks, and hypervigilance are possible

and ought to be directly assessed. The same functional analytic strategy would be applied to these difficulties.

## II. THEORETICAL BASES

Although the concept of functional analysis can be identified with a variety of schools of thought, it is most commonly associated with the behavioral tradition. The core position suggests that if we want to understand behavior, we must understand the context, both historical and current, that produced and maintain the behavior of interest. Advocates of this position have sometimes maintained that environmental events are the real determinants of behavior. A somewhat softer position, called functional contextualism, holds that behavior may be understood in terms of its functional relation to environmental events and that such a method of understanding leads quite naturally to effective interventions, because the analysis points to manipulable aspects of context. Stated in this way, the position does not exclude other methods of understanding behavior, it simply claims this one as an effective strategy for the prediction and influence of behavior.

## III. EMPIRICAL STUDIES

As previously stated, functional analysis is not a treatment, instead it is an analytic strategy that provides a basis for treatment. As such, there are not studies of functional analysis per se. However, functional analyses are components of many well-validated treatments. Functional analysis as a component in treatment development is most clearly and explicitly described in journals such as the *Journal of Applied Behavior Analysis* and *Behavior Modification* that tend to have a behavior analytic focus. Within them, one may find hundreds of studies treating a diversity of behavior problems, such as tic disorders, infant feeding problems, trichotillomania, and self-injurious behavior, as well as a wide variety of behavior deficits among populations with both developmental disabilities and normal development such as daily living skills, job skills, communication skills, academic skills, and social skills, among others.

Although less explicit in the published journal articles, functional analysis exists as a key component in a wide variety of empirically supported behavioral and cognitive-behavioral treatments. For example Michael Kozak and Edna Foa's treatment manual for obses-

sive-compulsive disorder, David Barlow and Michelle Craske's anxiety and panic manual, and Stewart Agras and Robin Apple's eating disorders manual all contain careful assessment of antecedents, behaviors, and the outcomes of those behaviors. Although early behavioral treatments were focused on external antecedents and consequences, more recent advances such as Barlow and Craske's panic treatment include a wide variety of interoceptive antecedents that are directly targeted in treatment. In these instances, negative mood, cognition, and bodily states can be thought of as both problematic behavior and as antecedents for other problematic behaviors. Using panic disorder as an example, someone may have a panic attack at a shopping mall and begin avoiding shopping malls. Panic as a response pattern is problematic and can be analyzed in terms of its functional relation to external events, such as the shopping mall. However, individuals with panic also begin to avoid activities that will precipitate early indicants of autonomic arousal, such as avoiding exercise to avoid increased heart rate. Thus, avoiding exercise can be understood distally in terms of the shopping mall, but more proximally in terms of bodily states associated with panic attacks at the mall.

## IV. SUMMARY

Functional analysis is a theory-driven approach to understanding behavior in terms of its context. It involves the organization of our understanding of behavior into three primary categories, including (1) antecedents, both remote and proximal, and also including internal and external cues; (2) the behavior of interest; and (3) consequences of that behavior. The analysis proceeds on the assumption that manipulation of antecedents and/or consequences can produce changes in relevant patterns of behavior. Identification of antecedents includes both discriminative stimuli and conditioned aversive and appetitive stimuli. Assessment of the behavior of interest involves examination of frequency, intensity, duration, and variability in the problem behavior. Identification of consequences includes assessment of potentially reinforcing and punishing consequences for the behavior of interest. Having gathered this information, a case formulation is made in terms of the well-established behavioral principles of operant and respondent conditioning and the interaction of these two conditioning processes. A wide variety of interventions have emerged from this functional perspective on behavior, including very

straightforward interventions involving reinforcement of appropriate classroom behaviors to the treatment of complex adult clinical problems like panic disorder with agoraphobia.

### See Also the Following Articles

### Further Reading

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