Behavior Modification in Applied Settings
Sixth Edition

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CHAPTER 2

* Principles of Operant Conditioning

Contingencies: The ABCs of Behavior

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Summary and Conclusions
Behavior modification programs rely on all three kinds of learning—classical conditioning, operant conditioning, and observational learning—as discussed in the previous chapter. In applied settings such as the classroom, home, hospitals, institutions, and society at large, behavioral programs rely heavily on the principles of operant conditioning. This chapter provides an overview of basic principles. It is important to consider several principles together to convey a way of conceptualizing how to go about intervening to change behavior. In later chapters, principles noted here will be considered in greater detail to convey research findings, applications of the principles, and how to conduct interventions to ensure they are effective.

CONTINGENCIES: THE ABCS OF BEHAVIOR

The contingencies of reinforcement refer to the relationships between behaviors and the environmental events that influence behavior. Three components are included in a contingency, namely, antecedents (A), behaviors (B), and consequences (C). The notion of a contingency is important not only for understanding behavior but also for developing programs to change behavior. Antecedents refer to stimuli, settings, and contexts that occur before and influence behaviors. Examples include instructions, gestures, or looks from others. Behaviors refer to the acts themselves—what individuals do or do not do—that is the focus of the program. Consequences refer to events that follow behavior and may include influences that increase, decrease, or have no impact on what the individual does. Table 2-1 illustrates the three components of a contingency with simple examples from everyday life. The examples convey what some of the ABC's are and how they are related. We shall build on this table in this chapter. Even with the simple examples in the table, one can see the interdependence of A, B, and C.

Consider the first line of the table that includes the behavior “answering the phone.” Antecedents are obviously critical and clearly control behavior. For example, the ringing of a telephone usually leads to behavior, namely, going over to and picking up (answering) the phone. Not too many people run to answer the phone when there is no ring (antecedent). Consequences are rather important in this example too. We repeatedly answer ringing telephones because of the consequences that regularly follow our behaviors, namely, that there is almost always someone on the other end of the line to speak with us.

It is useful to convey a simple example here merely to define and identify antecedents, behaviors, and consequences. It is also important to recognize that ABCs are more complex than one antecedent, one behavior, and one consequence. For example, in the phone call example, we may not answer a ringing phone. If we are expecting a call from someone with whom we do not wish to speak or are on our way out, we may not answer. Stated another way, the context or circumstances form part of the antecedent events and may change how we respond—in this case whether we answer.

Developing effective programs depends on understanding the influences of antecedents and consequences and how they can be used to promote, develop, and maintain behavior. A misguided and somewhat superficial view of behavioral in-
Table 2-1  Three Components of a Contingency
and Illustrations from Everyday Life

<table>
<thead>
<tr>
<th>Antecedent</th>
<th>Behavior</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telephone rings</td>
<td>Answering the phone</td>
<td>Voice of person at the other end</td>
</tr>
<tr>
<td>Wave (greeting) from a friend</td>
<td>Walking over to the friend</td>
<td>Visiting and chatting</td>
</tr>
<tr>
<td>Parent instruction to a child to clean the room</td>
<td>Picking up toys</td>
<td>Verbal praise and a pat on the back</td>
</tr>
<tr>
<td>Warning not to eat spoiled food</td>
<td>Eating the food</td>
<td>Nausea and vomiting</td>
</tr>
</tbody>
</table>

Interventions focus on consequences alone. Indeed, sometimes merely providing consequences for behavior in a casual way is taken as an application of behavior modification (e.g., “I praise my child when he does what I ask, and he still never listens.”) A curse of behavior modification is the view that casual efforts to apply minute aspects of the approach can be effective. Occasionally such efforts might work just like taking a few days of an antibiotic may make one feel better or even eliminate an infection. However, this is not the approach or the intended intervention. Behavioral interventions can be extremely effective. What is useful about the approach is that many of the conditions that dictate effectiveness have been well studied.

Antecedents, behaviors, and consequences are described in detail to convey and to illustrate key concepts. Although they are distinguished and separated for purposes of presentation, they are quite interrelated. For example, we walk into a room and see an odd facial expression on a person. That facial expression (antecedent to the next behavior) may prompt a behavior from us (e.g., we say, “What happened?” or “Is everything all right?” or “I didn’t do it!”). Many antecedent events such as facial expressions can acquire their influence because of their association with certain consequences. We may have learned from frequent pairings of various facial expressions (e.g., from our own direct experience or from movies, books, and cartoons) with various consequences. Also, in any given interchange, ongoing sequences of antecedents, behaviors, and consequences occur. It is useful to dissect the ABCs at this point to convey more clearly what they are.

**ANTECEDENTS OF BEHAVIOR**

Behavior is influenced greatly by antecedents or what comes before the behavior is performed. Three types of antecedents are distinguished here, including setting events, prompts, and discriminative stimuli. They are easily confused; after all, they all come before behavior. Consequently, several examples are provided.

**Setting Events**

At the most general level, setting events are antecedent to behavior. Setting events refer to contextual factors or conditions that influence behavior. They are broad in scope
Table 2-2  Types of Antecedents and Illustrations

<table>
<thead>
<tr>
<th>Type of Antecedent</th>
<th>Key Characteristics</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting event/establishing operation</td>
<td>Alters value of the reinforcer and increases likelihood of engaging behaviors to obtain the reinforcer</td>
<td>Being deprived of a reinforcer (e.g., food, water, attention); exposure to a pleasant or unpleasant interaction; a success or failure experience</td>
</tr>
<tr>
<td>Prompt</td>
<td>Some event or stimulus that directly guides and facilitates performance; directly connected to the behaviors to be performed</td>
<td>Instructions to guide how to hold, play, or use a musical instrument, modeling (showing) how to do something; guiding physically as a child learns how to form letters during a handwriting lesson</td>
</tr>
<tr>
<td>Discriminative stimuli (S’)</td>
<td>A stimulus or event indicating that a particular behavior is likely to be reinforced; the stimuli indicate that the reinforcer is available</td>
<td>The ring of a telephone (signaling that someone is likely to be on the other end of the line), the sound of a timer (indicating the food is ready from the oven); an enticing smile from an attractive person (signaling that approach behavior is likely to be reciprocated)</td>
</tr>
</tbody>
</table>

and set the stage for the behaviors and consequences that follow. Setting events include features of the situation, features of the task or demands presented to the individual, conditions within the individual (e.g., exhaustion, hunger, expectations of what will happen), or behaviors of others. Table 2-2 (top row) provides a few examples. Consider another example in greater detail. A child, getting ready for school, may hear a heated argument or perhaps witness violence between his or her parents right before going to school. That morning at school, the child may be a little more irritable, more reactive, and less attentive to schoolwork than usual. The child’s behaviors (e.g., talking to peers, paying attention, completing assignments, provoking arguments) are changed. The changes are not due to consequences or anything different at school but rather to events that altered the child, his motivation, and the set with which he approached school.

Setting event is useful and easy to remember as a term in part because it conveys that some event or factor "sets the stage" and influences behavior. External or environmental events (e.g., the actual setting such as home, school, a restaurant, the behavior of others in the setting), as well as internal states and events (e.g., feeling irritable, having had a wonderful or poor night’s sleep, being deprived of food, water, companionship) all qualify as setting events insofar as they can influence subsequent performance. A more precise and specific term is establishing operation, which refers to an antecedent variable or factor that temporarily alters the effectiveness of some other event or consequence (Michael, 1993). Motivational states, emotions, and environmental events are establishing operations if they momentarily alter the effectiveness of the consequences that may follow behavior and influence the frequency of some behavior. Two conditions are required to qualify as an establishing operation. First, such operations alter the effectiveness of consequences (reinforc...
ing and punishing events) in the environment. Second, such operations influence the frequency of behaviors that can obtain these consequences.

Consider an example. Assume for a moment that food reinforcement is available for a given response of a laboratory animal or human. Let us say the reinforcement it always available and can be obtained anytime a response is performed. Deprivation of food or of the individual will influence the likelihood of the response. When the individual is deprived, the effectiveness of food as a reinforcer is much greater than it would otherwise be, and behaviors associated with obtaining food become more probable. In other words, deprivation is an establishing operation, that is, an antecedent condition that influences the effectiveness of food as a reinforcer and increases the likelihood of engaging in responses that obtain food.

This example is good in isolating what is the establishing operation, what is the reinforcer, and what might be the behaviors that are increased as a result. In everyday life, the operations may be complex and more difficult to identify. Setting events is used here as a broad term to encompass many such influences that serve as establishing operations, even though the criteria for the two conditions noted above are not always met. For example, how parents interact with their oppositional children appears to be influenced by parent social interaction outside the home (Wahler, 1980); that is, for the parent, social interaction with others serves as an establishing operation for how they interact with their children. When mothers experience positive social contacts outside the home with friends, they show fewer aversive interactions with their children (commands, reprimands) and as a result, promote less deviant child behavior at home. As assessed on a daily basis, mothers' social interactions seem to provide a setting event that influences subsequent contingencies in the repertoire of the mothers and then their children. Of course, it is not a brilliant insight to say that how things are going in one part of a person's life can influence how things go in another part. Yet, the key insight here is that by understanding these relations more systematically, one can intervene to change behavior.

The world often tinkers with setting events to influence our motivational states and the likelihood of engaging or not engaging in various behaviors. For example, some airlines play music when people are boarding the plane. The music is carefully selected to be familiar and upbeat but not discordant or unpleasant. The goal is to have the stimuli evoke pleasant feelings about travel, the flight that is about to begin, and the experience of the particular airline. Similarly, when people are selling a home, a not-so-old-old trick is to make the stimulus conditions of the home appear very "homey" as potential buyers walk through the house. This is accomplished by having cake or bread baking in the oven or by boiling potpourri (flowers, cinnamon) on the top of the stove. The scents are assumed to set the stage for warm, fuzzy, and homelike behaviors, thoughts, and feelings on the part of potential buyers and more importantly, to increase the value of obtaining the "reinforcer" (i.e., purchase of the home).

Setting events are important, which is not the same thing as saying they are completely understood (McGill, 1999; Smith & Iwata, 1997). They are often difficult to identify because they do not necessarily occur immediately before behavior. Having a child, losing a parent, and winning a lottery are broad influences
that are not likely to be analyzed in a laboratory but in part, serve as critical influences on subsequent behavior. In everyday life, one can often identify relations between setting events and behavior and use these relations to develop interventions. For example, one can see a parent issue a harsh-sounding command to a child to do something. The child may not comply with the command and may even say “no” in an obstinate fashion. A harsh order or command from a parent sets the stage for noncompliance. This is not a matter of blaming the parent for the child’s noncompliance; blame is not relevant. What is relevant is that how the request was made, perhaps when it was made (e.g., in light of the child doing something else such as watching a favorite TV show), and what was in the request (e.g., no choices given, demand for immediate compliance rather than a little warning). That is, the command itself is an establishing operation that could affect the child’s motivation and his or her likelihood to respond in one way rather than another. Clearly, an important agenda for research is to understand how such influences take place; an important agenda for intervention is to use setting events to help promote adaptive behavior. From the discussion of setting events, one can see immediately that understanding and changing behavior is more than merely connecting behaviors with consequences. The initial events, stimuli, and states of the individual influence subsequent behavior and hence have to be considered.

Prompts

Prompts refer to specific antecedents that directly facilitate performance of behavior. They are distinguished from setting events, which are more contextual, indirect, and broad influences on behavior. Table 2-2 (middle row) provides some examples of prompts. Other examples include instructions to engage in the behavior (“Please wash up before dinner.”), cues (reminders or notes to oneself, lists of things to do), gestures (come in, leave the room), examples and modeling (demonstrations to show how the behavior task, or skill is done), and physical guidance (guiding a person’s hands to show her how to play a musical instrument or how to hit a volley ball).

Prompts serve as antecedent events (instructions, gestures) that help generate or initiate the desired response. They are designed to facilitate the response. When a prompt results in the response, consequences can be provided (positive reinforcement) to increase the likelihood that the response will occur. Without the prompt, the response might occur infrequently or not at all.

Prompts play a major role in developing a behavior. When an individual does not engage in the behavior, prompts can show the person what to do, how to do it, and when to do it. For example, one might want to provide reinforcing consequences to develop a complex set of behaviors (driving a car, completing a term paper) or a simple behavior that never occurs (eating specific foods). If the desired behavior never occurs, it cannot be reinforced. Assisting a person in beginning the response can enable the person to make more rapid approximations of the final response.

When a person has partially mastered the task or skill, prompts can help refine the behavior and help add to the complexity. For example, when teaching a
complex ballet or tango dance step, the teacher at first may model (a prompt) basic movements. As the skill is acquired, the teacher may model more subtle little movements of the hands, body, or legs to develop these more specific behaviors.

Several different types of prompts can be used alone or in combination. For example, several prompts were used to teach a job skill to profoundly retarded adult women (Schepis, Reid, & Fitzgerald, 1987). The women could comply only with simple requests and engaged in aggressive and self-injurious behavior. The goal was to train a job skill that consisted of preparing envelopes for mailing, including stamping a return address on the envelopes. To train the task, different kinds of prompts were used. Verbal instructions (verbal prompt) were provided to explain the sequence of behaviors; modeling (visual prompt) was provided if the individual did not show the requisite behaviors; finally, the individual was aided by guiding her through the task with physical assistance (physical prompt). These prompts were designed to increase the likelihood of correct performance of the behaviors, so that the reinforcer (in this case praise) could be provided. While a response is being developed, prompts may be used frequently to facilitate performance of the terminal response.

In most cases, the long-term goal is to develop a behavior so that it is performed without the use of prompts. Although prompts may be required early in training, they can be withdrawn gradually or faded as training progresses. Fading refers to the gradual removal of a prompt. If a prompt is removed abruptly early in training, the response may no longer be performed. But if the response is performed consistently with a prompt, the prompt can be progressively reduced and finally omitted. For example, teaching a person how to serve in tennis or how to play the piano may include reminders (prompts) regarding how to hold the racket or how to place one's fingers on the keys. As the person begins to perform these behaviors, the nature of the prompt may change (e.g., from "hold your fingers like this" [with the positioned modeled by the teacher] to "fingers" [without any other verbal statement or modeling]). Prompts are also provided less often. The correct behaviors are reinforced without reminders, and soon these behaviors do not need to be prompted at all or only rarely.

For example, in the study mentioned previously, prompts were used to train a specific set of behaviors with mentally retarded women. Over the course of training and as the behaviors were performed correctly, trainers began to fade the prompts. More intrusive (physical) prompts were decreased and the number of prompts was decreased over time. The goal was to develop the behavior so that it could be performed independently (i.e., without prompts). This goal was facilitated by introducing prompts to develop the behavior, then gradually fading and eliminating the prompts, and finally reinforcing the responses in the absence of prompts. It is not always necessary to remove all prompts. For example, it is important to train individuals to respond in the presence of certain prompts, such as instructions, that exert control over a variety of behaviors in everyday life.

Prompts have uses other than in training new behaviors. For behaviors that are readily available, prompts can play a useful role. For example, getting people to take medication is difficult, even though there may be strong incentives to do so. Many factors are involved, but one of them is that there may be no clear cues to
take the medication as prescribed. Prompts can help. For example, many women take oral contraceptives. Of these, almost half forget to take the pill at least once a month. Surveys show that pill users consider remembering to take the pill every day as a disadvantage of this method of birth control. Indeed, approximately one million unintended pregnancies in the United States each year are attributed to misuse, failure, or discontinuation of birth control pills. There are many solutions to this problem, including the use of birth-control methods that do not require engaging in a particular behavior every day. However, prompting might help those who wish to take the pills. To that end, one company that manufactures an oral contraceptive pill, Organon, Inc., has developed a card (size of a credit card) that beeps at the same time every day for 3 months to remind the woman to take the pill (www.organonwomen'shealth.com). Hearing the beep each day would be likely to serve as an effective prompt. Of course, ensuring that the card is around, available, and audible is another issue. Even so, the card conveys the use of prompts, namely, to help initiate the behavior.

High-Probability Requests

Making requests is a special type of prompt that warrants separate comment. An antecedent statement is provided to someone to engage in a behavior and, hopefully, initiates the behavior. Precisely how the request is delivered influences greatly the likelihood that there will be compliance. Consider an experience common among parents. Parents often ask young children to do various sorts of mundane tasks (e.g., get ready for dinner, clear the dinner table, start your homework). Based on the child's compliance to many such instructions, the parent is likely to say that the child does or does not comply very well. Certainly individuals differ in the extent to which they respond to instructions, all else being equal. Yet, precisely how instructions and requests are presented (i.e., antecedents) can make a major difference.

Considerable research has been conducted on the presentation of requests and how the presentation influences compliance. Two types of requests have been distinguished, namely, those an individual is very likely to do (called high-probability requests) and those an individual is very unlikely to do (low-probability requests). The specific requests that fall into these categories vary for individuals. Consider for a moment that a parent wishes the child to comply with several requests that she or he does not do (e.g., do a chore, complete another task). Throughout the day, if the parent asks the child to comply, the low-probability requests are rarely completed. However, if the parent first asks the child to do a few high-probability requests (e.g., "Please see if your sister is upstairs," "Write down 'fruit' on the grocery list," "Watch 'TV' before dinner"), the child is much more likely to comply with a low-probability request that follows. Embedding a low-probability request in a sequence of high-probability requests increases the likelihood of compliance with a low-probability request (Arnold, Mertens, & Wolfe, 1979; Mace & Belfiore, 1990).

As an example, two otherwise "normal" 4-year-old girls were identified because they did not comply with several requests (Roeser & Mittenberger, 1994).
High- and low-probability requests were identified by testing compliance. Once identified, the intervention began by first making three high-probability requests (e.g., simple commands like “Touch your nose”) followed by a low-probability request (e.g., “Put your glass in the sink”). The children greatly increased their compliance with low-probability requests when these requests were preceded by high-probability requests.

Many other such demonstrations have been provided. In one case, compliance with a request to hold still during a complex medical procedure was increased in a 22-month-old by first providing high-probability requests (M. Comas, Wacker, & Cooper, 1998). A sequence of requests such as (1) “Touch your head,” (2) “Say ‘Mom,’” (3) “Blow Mom a kiss,” and (4) “Hold still” were provided. In this example, requests 1, 2, and 3 were high-probability requests. The fourth was a low-probability request and was much more likely to lead to compliance when preceded by the first three requests. The demonstration underscores the importance of antecedents in controlling behavior and also the significance of how instructions are provided in addition to what the instructions are.

**Discriminative Stimuli and Stimulus Control**

Setting events and prompts could be presented without too much discussion of consequences. Stimulus control is not so easy. Stimuli often become associated with various consequences. Once these associations occur, the stimuli themselves exert control over behavior. Thus to understand the influence of the stimuli, antecedents, behaviors, and consequences must be considered together.

In some situations (or the presence of certain stimuli), a response may be reinforced; in other situations (in the presence of other stimuli), the same response is not reinforced. The concept of differential reinforcement is central to understanding stimulus events and their influences. **Differential reinforcement refers to reinforcing a response in the presence of one stimulus or situation and not reinforcing the same response in the presence of another stimulus or situation.** When a response is consistently reinforced in the presence of a particular stimulus and not reinforced in the presence of another stimulus, each stimulus signals the consequences that are likely to follow. A stimulus whose presence has been associated with reinforcement is referred to as a **discriminative stimulus (S^D)**. A stimulus whose presence has been associated with nonreinforcement is referred to as a **non-discriminative stimulus (S^N** or **S delta)**. The effect of differential reinforcement is that eventually the reinforced response is likely to occur in the presence of the S^D but unlikely to occur in the presence of the S^N. When responses are differentially controlled by antecedent stimuli, behavior is said to be under **stimulus control**. When there is stimulus control, the presence of a stimulus increases the likelihood of a response. As mentioned previously, the stimulus does not cause response or automatically elicit the response the way reflexes are elicited in classical conditioning. Rather, in operant conditioning, the stimulus (an S^D) increases the probability that a previously reinforced behavior will occur.

Some examples are provided in Table 2-2 (bottom row). Another more detailed example is when a stranger smiles at you on the street, there is an increase in
the likelihood that we too will smile and say something friendly. Also, if we smile back, it is very likely the person will say something back to us. Stated a bit more precisely, smiling is a signal (an $S^o$) that specific behaviors on our part (acts of friendliness) are likely to be reinforced (acknowledged, reciprocated). We do not usually initiate friendly statements to others who present us with a grumpy facial expression. A grumpy facial expression is an $S^r$, it indicates that the reinforcer is not likely to follow. Smiling and grumpy faces of strangers do not elicit behavior from us in a reflexive way but rather increase the likelihood of certain behaviors on our part.

Stimulus control is learned, so not everyone responds in a friendly way when confronted with a smiling stranger, that is, what becomes an $S^o$ for each of us may vary, although there are likely to be commonalities in a given culture. For example, when a robber confronts us, this is not an $S^o$ for really friendly, social, back-slapping behavior on our part. The cues that robbers present (weapon, hostile demeanor, outfit, context) suggest that probably only one response will be reinforced (i.e., giving the person the object demanded).

Instances of stimulus control pervade everyday life. For example, the sound of a doorbell signals that a certain behavior (opening the door) is likely to be reinforced (by seeing someone). Specifically, the sound of the bell has often been associated with the presence of visitors at the door (the reinforcer). The ring of the bell ($S^o$) increases the likelihood that the door will be opened. In the absence of the bell ($S^r$), the probability of opening the door for a visitor is very low. The ring of a doorbell, telephone, alarm, and kitchen timer all serve as discriminative stimulus ($S^o$) and signal that certain responses are likely to be reinforced. Hence, the probability of the responses is increased.

Stimulus control is pervasive and guides much of our behavior. Consider the selection and consumption of food. For example, the color and smell of foods (such as an orange that has turned green or milk that smells sour) influence the likelihood of eating them. Characteristics of the foods are cues for particular consequences (such as flavor or nausea) and exert stimulus control over our eating. In recognition of the importance of the stimulus, natural foods (fruit) or products (beverages) often have artificial colors and fragrances added to increase the likelihood of their purchase. Wedding rings that people wear also exert stimulus control. Wearing a wedding ring is an $S^o$ that certain behaviors on the part of others (e.g., flirtation, asking one out for a date) are not likely to be reinforced. Presumably a wedding ring is also an $S^o$ to the individual who wears it and decreases the likelihood of engaging in certain behavior (initiating new romantic relationships). Of course, marital behavior is controlled by many more influences within the individual and environment than wedding rings, but stimuli are present that serve as important cues.

People in everyday life are quite familiar with the concepts of differential reinforcement and stimulus control, although these terms, of course, are not used. For example, children behave differently in the presence of their mothers and fathers in part because of the slightly different reinforcement contingencies that operate with each parent. Children often know whom to ask (mother or father) in making specific requests because the likelihood of reinforcement (affirmative
answer) differs between parents on various issues. Similarly, at home children often behave quite differently from how they behave at school. The different performances may lead to perplexed parents and teachers who argue that the child is not “really” like that. Yet, the child’s behavior may vary considerably as a function of different reinforcement contingencies at home and at school.

The notion of stimulus control is exceedingly important in behavior modification. In many programs, the goal is to alter the relation between behavior and the stimulus conditions in which the behavior occurs. Some behavior problems stem from a failure of certain stimuli to control behavior when such control would be desirable. For example, children who do not follow instructions given by their parents illustrate a lack of stimulus control. The instructions do not exert influence over the children’s behavior. The goal of a behavior modification program is to increase responsiveness to instructions.

BEHAVIORS

We have considered the antecedents of the ABCs of contingencies. Behavior change is achieved by identifying the behaviors of interest, that is, the behaviors that one wishes to develop. These are called target behaviors. Of course, one does not merely identify behavior but rather plans how to develop them systematically. Two procedures figure prominently in developing behavior—shaping and chaining.

Shaping

The individual may perform target behaviors already and the goal of the intervention may be to increase performance in some way (e.g., more occasions in which the behavior is occurring, longer periods engaging in the behavior, or fostering the behavior in new situations). In these instances, providing antecedents and consequences may be sufficient to increase or extend the behavior. In many other cases, the individual does not have the behavior in his or her repertoire or only has the behavior partially. In these cases, one cannot merely wait for the behavior to occur and provide consequences; the response may never occur. The desired behavior may be so complex that the elements making up the response are not in the repertoire of the individual. The behavior can be achieved by reinforcing small steps or approximations toward the final response rather than reinforcing the final response itself.

The reinforcement of successive approximations of the final response is referred to as shaping. Responses are reinforced that either resemble the final response or include components of that response. By reinforcing successive approximations, the final response is gradually achieved. Responses increasingly similar to the final goal are reinforced, and they increase; responses dissimilar to the final goal are not reinforced, and they extinguish. For example, when parents are trying to develop the use of the words “mommy” or “daddy” in an infant, they usually reinforce any approximation (“ma” or “da-da”) by smiling, hugging, and praising effusively. At the same time, but usually without thinking about it, they do not attend to (or
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extinguish) sounds that are not close to the words they wish ("goo" or "milk"). Over time, the parents reinforce sounds and syllables that come closer to the words mommy and daddy.

An obvious example of shaping is training animals to perform various tricks. If the animal trainer waited until the tricks were performed (e.g., jumping through a burning hoop) to administer a reinforcer, it is unlikely that reinforcement would ever occur. Animals normally do not perform such behavior. By shaping the response, the trainer can readily achieve the terminal goal. First, food (positive reinforcer) might be delivered for running toward the trainer. As that response becomes consistent, the trainer might reinforce running up to him when he or she is holding a hoop. Other steps closer to the final goal would be reinforced in sequence, including walking through the hoop on the ground, jumping through it when it is partially on fire, and finally, jumping through it when the hoop is completely on fire. Eventually, the terminal response will be performed with a high frequency, whereas the responses or steps developed along the way will have been extinguished.

An example of shaping I recall from my own college years was conducted in class with my peers. This was a psychology class of about 25 students. The professor in class stood in front of a small lectern on a table in the front of the class. He rarely looked at his notes on the lectern but he remained in the center of the class right in front of them all of the time, except when writing on the blackboard immediately behind him. My peers thought how interesting it might be to see if we could shape his behavior. The terminal goal or target behavior was to get the professor to stand and lecture in the corner of the room (to the right of him). Several students met and decided to do this, although the entire class was not involved.

To shape the behavior one needs a reinforcer. This was not too difficult. Eye contact, attention, mild nods of understanding, and enthusiasm all are likely to be positive reinforcers for poor professors who occasionally glare at a sea of inattentive students who have been up until 3 or 4 in the night before. (Of course, many professors foster inattentiveness by the content and style of their lectures.) Hence we have the terminal response (lecturing from a specific corner in the room) and a consequence (attention, eye contact, looks of interest) likely to serve as a reinforcer.

Of course, we could never directly reinforce the terminal response of interest. One shapes behavior because the final behavior is not present in the repertoire of the individual. The professor never went into the corner or anywhere near it. For shaping, we decided to sit up and look interested, make eye contact, and so on whenever he moved a little bit (one step) toward the corner of the room. There is always variability (variation or departures from one’s average performance) in behavior, so little changes (movements in one direction or another) occur naturally. On the first day of the intervention, the first time he moved (maybe one-half foot from the center of the lectern), several students in the class leaned forward a bit and looked a little more alert, interested, and attentive than usual. (Yes, it was difficult not to laugh; I readily recall most students in my entire row leaning forward on this occasion.) Thus the initial approximation toward the
terminal behavior received attention. This does not necessarily alter all behavior for all time, but it would increase the likelihood of that behavior in the future. He naturally went back to the center of the podium and those same students looked away, that is, they reclined back in their seats and looked down or at their notes. This continued for awhile, whenever he moved to his left, we—he mean, those mischievous other students—leamed forward and looked attentive. He was still about 15 feet from the corner of the room, but shaping was continued. We had time because the course met 3 days per week and was for an entire semester.

Once he was a little away from the center of the room on a regular basis, there would be variation in his performance here too, so naturally, he would move a little more to his left or right. When he moved a little more toward the corner, again the students looked (alive. After a few days, the students no longer looked enthusiastic or attentive when the professor was just a little away from the center of the room. We held out for a little more and then a little more. In shaping, one reinforces behaviors that increasingly approximate the final goal and stops reinforcing those early approximations that are well established. After about two weeks of this, the guy was in the corner leaning against the wall lecturing solidly for the entire period. Occasionally he would wander back, peek at his notes but invariably stroll back to the corner. Of course, the class really paid attention all of the time he was in the corner and less so when he wandered back. One day, he raised his foot and placed it on the wastebasket that was also in the corner. My peers spontaneously provided copious attention and leaned forward and thought this would be a great addition to the terminal goal. This behavior increased for a few days too but a few students wanted to stop the program. Clearly the terminal response was achieved, and we had entire lectures delivered from the corner of the room, again baring occasional trips to peek at the notes.

This is almost the end of the shaping example, but not the story. A few students with good values, nice training, and ethics thought that we should return him to where he was before our shaping program began. Also, most of the students involved in the program were pretty tired of sitting up and looking interested, as was needed for 50 minutes three times a week. To begin with, the class did not engender great enthusiasm. Even so, the students agreed to continue the program to reverse the process. Now, attention was provided for staying in the middle of the room and lecturing from there. This was easier to obtain because the professor occasionally left the corner and visited his notes placed on the lectern in the center of the room. Hence, the new terminal behavior (being in the center of the room) was already evident, so we just had to be sure to reinforce this whenever it occurred. This behavior readily developed and the program ended with weeks to spare before the end of the term.

As this example shows, shaping begins by reinforcing behaviors already in the repertoire of the individual that resemble or approximate the final goal. The behaviors already in the repertoire initially were these spontaneous slight movements away from the center of the room and in the direction of the corner. As the initial approximation is performed consistently, the criterion for reinforcement is altered slightly so that the response to be reinforced resembles the final goal more closely than does the previous response. Through reinforcement of
responses that approach the final goal and extinction of responses that do not, the terminal response is developed. In shaping the goal is to attain a final behavior, and the behaviors along the way drop out or are replaced by behaviors that are closer and closer to the goal.

**Chaining**

Most behaviors consist of a sequence of several responses. A sequence of responses is referred to as a *chain*. A chain represents a combination or series of the individual responses performed in a particular order. For example, "getting dressed" is a behavioral chain that includes such behaviors as taking clothes out of the drawer, placing them on a bed, putting on a shirt, and so on for other articles of clothing. Putting on individual articles of clothing also consists of a chain of behaviors. Similarly, completing a term paper or writing a book consists of a sequence of behaviors such as identifying the topic, organizing what will be presented and in what order, obtaining pertinent materials, perhaps reorganizing the material, drafting the paper, and so on. These examples reflect chains of behavior because they comprise many individual responses that are linked together in a specific order.

Most behaviors in everyday life can be conceived of as chains of behaviors. Developing the sequence of behaviors is a process referred to as *chaining*. Chaining occurs by reinforcing completion of the full sequence of behaviors, that is, rather than just developing one behavior, a sequence of multiple behaviors occurs. Reinforcement is provided for completion of the sequence of behaviors. Consider a sequence of behaviors as putting on a shirt, a dressing skill sometimes taught to severely mentally retarded children who cannot dress themselves. Let us assume for the moment that this is a pullover shirt and that the sequence of individual behaviors consists of:

1. Taking the shirt from the drawer
2. Spreading it out on the bed and picking up the shirt
3. Putting one arm through the sleeve
4. Then the other arm through the sleeve
5. Then putting one's head through
6. Finally putting it down to one's waist

This sequence of behaviors can be developed in different ways, namely by forward or backward chaining.

**Forward Chaining.** *Forward chaining consists of developing behaviors in the order in which they are to be performed,* that is, in the above sequence we begin by first developing step number 1. A child is assisted, with prompts, to take the shirt from the drawer. Perhaps a verbal prompt would begin this way: "Please put on your shirt," followed by physical assistance and guidance. Once the first behavior is performed, the reinforcer (praise, hug) is provided. The shirt goes back in the drawer and this is repeated. After awhile, the second behavior is added, and the child
would engage in behaviors 1 and 2 and then receive the reinforcer. This would proceed until the entire sequence is performed.

At first blush, forward chaining may seem to resemble or to be the same as shaping. They are different. Shaping usually is thought of as changing a behavior so it goes from one form to another. That is, the behavior may be changed along quantitative dimensions (maybe studying for 2 minutes) to another form (maybe studying for 20 minutes) or along qualitative dimensions (balancing on a beam first with one's hands stretched out to keep one's balance but eventually balancing without the hands out). Hence, there is a behavior that is developed. In shaping, the final behavior replaces all of the steps along the way; one does not see early behaviors that have been trained. They have been replaced.

Forward chaining develops behavior but there are multiple behaviors in a sequence and at the end of training, all of the original behaviors in the sequence are still there. Therefore in the dressing example, all of the behaviors in the sequence are still evident at the end of training; they are just performed in order in a seamless way.

**Backward Chaining.** Chaining can also be completed in a backward fashion. *Backward chaining consists of starting with the last behavior in the sequence, that is, one begins by training the last behavior first (step number 6 in the prior example).* Thus the training would begin by putting the shirt on the child almost completely with only one step remaining, namely, pulling it down to his or her waist. The child would be prompted to pull it down (maybe verbal prompts and physical prompts). When this behavior was completed, it would be followed by reinforcement. Once this is mastered, perhaps with a few more trials, then the shirt is put on up to the point of pulling the head through. Reinforcement would be provided at the end of completing both behaviors at the end of the sequence. This would continue until the first behavior in the sequence (taking the shirt from the drawer) was finally included.

**Why Backward Chaining?** Developing a sequence of behavior in a forward fashion seems so straightforward. Indeed, forward chaining makes intuitive sense as one builds additional behaviors after the first behavior is mastered. Why would backward chaining be used? Backward chaining requires an important discussion of how behaviors in a sequence relate to each other and to the consequences that follow at the end of a sequence.

In a sequence or chain of responses, the reinforcer usually comes only at the end, that is, after all the behaviors are completed. For example, dieting, mastering a musical instrument, preparing for athletic competition, studying for an advanced degree, and writing a book all require a series of intermediate responses before the final reinforcing event is achieved. The major question is, what maintains all of the intermediate responses that precede attaining the final goal? The behaviors early in the sequence simply might not be performed because they are so far removed from the final delivery of the reinforcer. The answer requires explaining the factors that link the response components of a chain and in the process why backward chaining makes sense and is effective.
To begin with, it is important to note that an event immediately preceding reinforcement becomes a signal for reinforcement. As mentioned in the discussion of antecedents, an event that signals a behavior will be reinforced is referred to as a discriminative stimulus (S0). An S0 sets the occasion for behavior; it increases the probability that a previously reinforced behavior will occur. An S0 not only signals reinforcement but also eventually becomes a reinforcer itself. The frequent pairing of an S0 and the reinforcer gives the S0 reinforcing properties of its own. The discriminative stimulus properties of events that precede the reinforcer and the reinforcing properties of these events when they are frequently paired with reinforcers are important in explaining how chains of responses are maintained.

Consider the chain of responses involved in completing a painting. The sequence may include an indefinite number of components, beginning perhaps with purchasing paints and canvases, sketching drafts of the painting on scratch paper, drawing an outline on the canvas itself, actually painting the canvas, and finally seeing the finished product. The first response (purchasing the materials) is quite far removed from completion of the painting. Assume for a moment that seeing the final product (or for those more materially oriented, selling the painting) is the final reinforcer. Only the final response—placing the final strokes of paint—is followed by the reinforcing consequences (seeing the finished product). This final response is directly reinforced with seeing the finished product.

Recall that any event that precedes delivery of the reinforcer becomes an S0. In this chain of responses, the last response performed (painting the final strokes) becomes an S0 for the reinforcer, since the response signals that the reinforcer will follow. Yet the pairing of an S0 with the reinforcer (seeing the product) eventually results in the S0 becoming a reinforcer, as well as a discriminative stimulus. Hence, the response preceding direct reinforcement has become an S0 for delivery of a subsequent reinforcer and a reinforcer in its own right. It serves as a reinforcer for the previous link in the chain of responses. The response (putting strokes on the canvas) becomes a reinforcer for the previous behavior (sketching the canvas). Since sketching the canvas now precedes the reinforcer, it too becomes an S0. As with other responses, the pairing of the S0 with the reinforcer results in the S0 becoming a reinforcer. The process continues in a backward direction so that each response in the chain becomes an S0 for the next response in the chain and serves as a reinforcer for the prior response in the chain.

Although the sequence appears to be maintained by a single reinforcer at the end of the chain of responses (seeing the finished product), the links in the chain are assumed to take on conditioned reinforcement value. To accomplish this, building response chains often relies on training from the last response in the sequence that precedes direct reinforcemend back to the first response. As noted previously, training the last response first is backward chaining. Because the final response in the sequence is paired immediately and directly with the reinforcer, it is most easily established as a conditioned reinforcer that can maintain other responses. Also, the shorter the delay between a response and the reinforcer, the greater the effect of reinforcement. The last response in the chain is immediately reinforced and is more likely to be performed frequently. Thus one can have the individual complete the final behavior and receive the reinforcing consequence
immediately. Then training proceeds to the second to the last behavior, followed by the last behavior, followed by the reinforcer. The assumption is that training will be easier in this fashion because the connection between the final reinforcement and behavior is immediate.

General Comments

In principle, shaping and chaining are both suitable for developing new behaviors. With each technique, prompts such as instructions or gestures and direct reinforcement such as praise may be provided for the desired behavior. The differences between shaping and chaining, as well as the conditions that dictate their use, may be unclear. The major difference is that shaping focuses on developing a specific behavior. Steps along the way toward the final goal are eventually replaced by the final behavior one wishes. In chaining, there is a sequence of behaviors. At the end, the behaviors developed along the way are still evident, that is, they do not drop out as behavior is developed.

In practice, shaping is the procedure used much more often to develop behavior. Sequences of behaviors (chains) can be developed by shaping and using cues and reinforcement for the performance of behaviors in a particular sequence. Thus in many situations either chaining or shaping may be used. For example, toilet training of children consists of a series of responses that follow in sequence: walking to a bathroom, lowering pants, positioning oneself in front of or on the toilet, and so on. After completion of the entire chain, praise for proper elimination can serve as the reinforcer. Both shaping and chaining have been effective in developing this sequence of responses (Azrin & Foxx, 1971; Mahoney, Van Wagenen, & Meyerson, 1971).

Forward and backward chaining can be used to develop sequences and both are effective. Direct comparisons have not established that one is consistently more effective than the other. In applied work, immediate reinforcement is usually provided for the desired response during the course of training. Thus in developing a sequence, one does not only provide the reinforcer when the final behavior at the end of the chain is performed. Usually one praises and prompts along the way. The use of reinforcement along the way in developing sequences of behavior helps both forward and backward chaining work well.

In applied settings, shaping and forward chaining usually are easily understood by those who observe and implement behavior modification programs. Intuitively, building behavioral units or sequences that are increasingly more complex and that move toward some final goal is consistent with everyday experiences in, for example, child development or mastering a skill, such as music training, where simple responses and smaller units precede more complex responses and larger units of behavior. The notion of chains of behaviors is very important because it alerts us to the fact that our interest is not merely in increasing certain behaviors but rather in building sequences of behaviors. For example, to increase a child’s completion of homework, the sequence of behaviors may include bringing home an assignment book and the books needed to do the homework, working on the homework, completing that homework, reviewing or showing this work to a
parent, taking it to school the next day or on the due date, and so on. In developing this sequence, it is important to be mindful of the constituent behaviors and the sequence of behaviors. At the inception of the reinforcement program, we may reinforce individual acts; eventually, we wish to reinforce the entire sequence of behaviors.

**CONSEQUENCES OF BEHAVIOR**

We have now considered antecedents and behaviors of the ABCs. In the process, we have also mentioned consequences that follow behavior. However, let us consider consequences more systematically and the different arrangements of consequences and behavior. The most basic feature of consequences is how they relate to behavior. Specifically, for a consequence to alter a particular behavior, it must be dependent or contingent on the occurrence of that behavior. Stated another way, behavior change occurs when certain consequences are contingent on performance. A consequence is contingent when it is delivered only after the target behavior has been performed and is otherwise not available. When a consequence is not contingent on behavior, this means that it is delivered independently or regardless of what the person is doing.

The noncontingent delivery of consequences ordinarily does not result in systematic changes in a target behavior because the consequences do not consistently follow that behavior. For example, elementary school teachers often prefer their students to raise their hands to be called on rather than blurt out the answer or talk or shout when their hands are up. Assume for the moment that teacher attention (calling on the person to answer) is the reinforcer. If the teacher wishes to develop hand raising, the teacher can make “calling on the person” contingent on the desired behavior. However, the teacher must be consistent so that calling on a student only occurs when the behavior is performed. If the teacher calls on students occasionally when hands are not raised or students are not sitting and waiting to be called on, the desired behavior will not develop systematically.

Consequences do not magically alter behavior; they must be delivered in specific ways, and one of these ways is contingent on desired performance. The notion of contingency is important because behavioral techniques alter behavior, in part, by modifying the consequences that follow behavior. In other words, it makes consequences contingent on behavior in ways that promote the desired behavior. The relationship of behavior and consequences are described by the concepts of reinforcement, punishment, and extinction.

**Positive Reinforcement**

Reinforcement always refers to an increase in the likelihood or probability of a response when that response is immediately followed by consequence. This is important to remember because there are different ways of following behavior with reinforcing consequences. Positive and negative reinforcers constitute the two kinds of events that
can be used to increase the probability of a response (Skinner, 1953). Positive reinforcers are stimuli or events presented after a response has been performed that increase the frequency of the behavior they follow. The word positive in this use essentially means something is presented. Negative reinforcers, which can also be referred to as aversive events or aversive stimuli, are events removed after a response has been performed that increase the behavior preceding their removal. Negative in this use essentially means something is removed or withdrawn. Let us consider these in turn.

Positive reinforcement refers to the increase in the likelihood or probability of a response that is followed by a favorable consequence (positive reinforcer). In everyday language, such positive or favorable events are often referred to as rewards. However, it is important to distinguish the term positive reinforcer from the term reward. A positive reinforcer is defined by its effect on behavior. If a consequence follows a behavior and the likelihood of the behavior increases in the future, the consequence is a positive reinforcer. Conversely, any event that does not increase the behavior it follows is not a positive reinforcer. An increase in the frequency or probability of the preceding behavior is the defining characteristic of a positive reinforcer. In contrast, rewards are defined merely as something that is given or received in return for doing something. Rewards such as prizes, sums of money, and vacations are usually highly valued and subjectively pleasing. Rewards do not necessarily increase the probability of the behaviors they follow.

In fact, many rewards or events that a person evaluates favorably when queried may serve as reinforcers. For example, people often say that money is a reward (i.e., they like it) and in fact, money, when applied to alter behavior in systematic ways, usually serves as a positive reinforcer. Yet, whether a consequence is a reinforcer cannot be known on the basis of a person’s verbal statements alone. A person may be unaware of or may not consider as rewards many events that are reinforcers. For example, verbal reprimands such as “Stop that!” can and taking someone out of the room to isolate them occasionally have served as positive reinforcers. It is unlikely that anyone would ever refer to these consequences as rewards. The key point is that a reward is not synonymous with a positive reinforcer. Whether an event is a positive reinforcer has to be determined empirically. Does the likelihood of the behavior to which the consequence was applied increase when the consequence immediately follows the behavior? The consequence is a positive reinforcer only if the behavior increases.

Examples of positive reinforcement in everyday life would seem to be abundant. Strictly speaking, rarely does anyone actually measure whether a favorable event that followed a behavior increases the likelihood of that behavior. Nevertheless, it is useful to mention some everyday situations that probably exemplify positive reinforcement. Winning money at a slot machine usually increases the frequency of putting money into the machine and pulling the lever. Money is a powerful reinforcer that increases performance of a variety of behaviors. As another example, if a child whines or complains before going to bed and is then allowed by his or her parents to stay up longer, the frequency of whining before bedtime may increase. Letting the child stay up is likely to be a positive reinforcer.
Types of Positive Reinforcers. Positive reinforcers include any events or stimuli that, when presented, increase the likelihood of the behavior they follow. The two categories of positive reinforcers are namely unconditioned or primary reinforcers and conditioned or secondary reinforcers. Unconditioned reinforcers are reinforcing without requiring special learning or training. Food and water are examples. Primary reinforcers may not be reinforcing all of the time. Food will not serve as a reinforcer to someone who has just finished a large meal. When food does serve as a reinforcer, however, its value is automatic (unlearned) and does not depend on a previous association with any other reinforcers.

However, conditioned reinforcers acquire their reinforcing value through learning. Examples include praise, grades, money, and completion of a goal. Conditioned reinforcers acquire reinforcing properties by being paired with events that are already reinforcing, either primary reinforcors or other conditioned reinforcers. If a neutral stimulus is repeatedly presented before or along with another reinforcing stimulus, the neutral stimulus becomes a reinforcer. For example, praise may not be reinforcing for some individuals. To establish praise as a reinforcer, it can be paired with a consequence that is reinforcing, such as food, money, or physical touch. When a behavior is performed, the individual's behavior is praised and reinforced with food. After several pairings of the food with praise, the praise alone serves as a reinforcer and can be used to increase the frequency of other responses (Lancioni, 1982).

Some conditioned reinforcers are paired with many different reinforcers. When a conditioned reinforcer is paired or associated with many other reinforcers, it is referred to as a generalized conditioned reinforcer. Generalized conditioned reinforcers are extremely effective in altering behaviors because they have been paired with a variety of events. Money is an example of a generalized conditioned reinforcer. It is a conditioned reinforcer because its reinforcing value is acquired through learning. It is a generalized reinforcer because a variety of reinforcing events contribute to its value. Additional examples of generalized conditioned reinforcers include attention, approval, and affection from others. For example, attention from someone may be followed by physical contact, praise, smiles, affection, or delivery of tangible rewards such as food and other events.

In behavior modification programs, generalized reinforcers in the form of tokens are often used (Kazdin, 1977). The tokens may consist of poker chips, coins, tickets, stars, points, or check marks. Tokens serve as generalized reinforcers because, like money, they can be exchanged for many other events that are reinforcing. For example, in an elementary school classroom, tokens may be delivered to students for raising their hands to speak, for completing assignments in class, for attaining correct answers, and for other behaviors. The tokens may be exchanged for special in-class activities such as educational games or movies, extra recess, or free time in class at the end of the day. The potency of tokens derives from the reinforcers that back up their value. The events that tokens can purchase are referred to as back-up reinforcers. Generalized conditioned reinforcers, such as money or tokens, are usually more powerful than any single reinforcer because they can purchase many different back-up reinforcers.
In identifying positive reinforcers, it is important to keep two considerations in mind. First, an event (e.g., praise, candy, or a pat on the back) may be a positive reinforcer for one person but not for another. Although some events have wide generality in serving as reinforcers, such as food or money, others may not (e.g., sour candy). Second, an event may be a reinforcer for one person under some but not other circumstances. These considerations require careful evaluation of what is reinforcing for a given individual. Because of common biological background, cultural norms, and experiences, some consequences are likely to be reinforcers for many people (e.g., praise from parents or peers, money). However, there is no guarantee that a particular event will be reinforcing. The critical test is whether the consequence, if contingent on behavior, increases the likelihood of that behavior in the future.

**Negative Reinforcement**

Negative reinforcement refers to the increase in the likelihood or probability of a response by removing an aversive event immediately after the response has been performed. Removal of an aversive event or a negative reinforcer is contingent on a response. An event is a negative reinforcer only if its removal after a response increases performance of that response (Skinner, 1953). The comments made about the difference between rewards and positive reinforcers hold for negative reinforcers as well. That is, consequences that are subjectively unpleasant or not liked very much may be annoying or otherwise undesirable. They are also likely to be useful as negative reinforcers, but not necessarily so. Whether a consequence really serves as a negative reinforcer can only be determined by seeing if the consequence can change behavior. Other qualifications are also pertinent. An undesirable event may serve as an aversive event for one individual but not for another. Additionally, an event may be a negative reinforcer for an individual at one time but not at another time. A negative reinforcer, like a positive reinforcer, is defined solely by its effect on behavior.

It is important to reiterate that positive or negative reinforcement always refers to an increase in behavior. Negative reinforcement requires an ongoing aversive event or stimulus that can be removed or terminated after a specific response has been performed. The aversive event is "just there" or present in the environment. Once this event is present, then some behavior may stop or end it. That behavior is negatively reinforced.

Positive reinforcement is familiar and more easily remembered than negative reinforcement because many examples of unsystematic reinforcement seem evident in everyday life. As a helpful aide, consider the following. In negative reinforcement, the desired behavior turns off an aversive event (e.g., stops a noise, stops pain). The behavior may not directly turn off the event like a switch, but has that effect. Performing the behavior results in the immediate termination of an aversive event. Think of situations of escape behavior as instances in which negative reinforcement is operating. Table 2-3 gives some examples to help remember the arrangement of consequences and behavior.

Consider two examples in greater detail. For example, a neighbor may be playing very loud music. This provides an aversive event needed as the first
Table 2.3  Examples of Negative Reinforcement

<table>
<thead>
<tr>
<th>Aversive stimulus, condition, situation</th>
<th>Behavior that is performed</th>
<th>Immediate effect is to end the aversive condition</th>
<th>Outcome or effect on behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritability and mild discomfort (from nicotine depletion)</td>
<td>Smoke a cigarette</td>
<td>Terminates the discomfort</td>
<td>Increase the likelihood of smoking in the future</td>
</tr>
<tr>
<td>Loud noise from an alarm clock</td>
<td>Throwing the clock across the room</td>
<td>Noise from the alarm ends</td>
<td>Increase the likelihood of throwing the clock</td>
</tr>
<tr>
<td>Nagging parent</td>
<td>Leaving the house or the room</td>
<td>Nagging no longer heard</td>
<td>Increase the likelihood of leaving (escape) in the future</td>
</tr>
<tr>
<td>Discomfort from extremely cold weather</td>
<td>Entering a building</td>
<td>Terminates the discomfort</td>
<td>Increase the likelihood of escaping cold</td>
</tr>
</tbody>
</table>

condition for negative reinforcement. Any response that terminates this could readily illustrate negative reinforcement. Let us say that someone who finds the music aversive screams, “Stop that music or I will call the police!” Assume for a moment that this behavior (screaming and making a threat) immediately stops the noise. This is precisely the arrangement for negative reinforcement, namely, termination of an aversive event or stimulus contingent on behavior. To qualify as reinforcement, of course, it is assumed that the neighbor is more likely to scream and threaten in the future when such noise occurs.

As another example, consider a person who is addicted to drugs. Depending on the drug, addiction may be partially maintained by negative reinforcement. Perhaps the person has had a dose of the substance. As the effect wears off, very unpleasant bodily sensations, discomfort, and even sickness may occur. This unpleasant state constitutes an ongoing aversive state. Perhaps the person injects or takes another dose of the medication and the aversive condition is terminated. Ingesting drugs is likely to be negatively reinforced by this arrangement.

The examples convey that escape from or terminating an aversive event can negatively reinforce behavior. Avoidance too is involved in negative reinforcement, but this is a bit more subtle. In avoidance, behavior is performed before the negative event even occurs. In the above examples, the negative event (loud music, discomfort as drug wears off) leads to escape. Cues and learned events that precede negative events often take on aversive properties, that is, they too become aversive. Engaging in behavior that terminates these learned aversive events, leads to negative reinforcement. Thus a teenager does not need to hear the nagging parent (aversive event). Escaping from a nagging parent (leaving the room) would be an example of negative reinforcement. A parent who nags a lot might well take on aversive properties and be avoided by the teenager. Thoughts about the parent or seeing the parent can become aversive, and termination of these also negatively reinforces behavior (see Chapter 6 for more on avoidance). However, it is useful here to consider that whenever escape or avoidance behavior occurs, negative reinforcement may be operating.
As with positive reinforcement, the two types of negative reinforcers are unconditioned (primary) and conditioned (secondary). Intense stimuli such as shock, loud noise, or very bright light that impinge on the sensory receptors of an organism serve as unconditioned negative reinforcers. Their aversive properties are not learned. In contrast, conditioned events become aversive by being paired with events that are already aversive. For example, disapproving facial expressions or saying the word no can serve as aversive events after being paired with events that are already aversive (Dorsey, Iwata, Ong, & Msween, 1989).

Negative reinforcement requires presenting the individual with some aversive event such as shock, noise, or isolation, that can be removed or reduced immediately after he or she responds. Because of the undesirability of using aversive stimuli, negative reinforcement is used infrequently in programs designed to alter behavior. Several less objectionable and more positive procedures are also readily available.

Although negative reinforcement is not used very often in behavior modification, it does play a role in everyday life. In fact, many interesting combinations of positive and negative reinforcement occur in everyday interactions. Consider two examples from parent-child interactions. A parent is waiting in line at a supermarket to check out groceries. In the checkout line with the parent is a 5-year-old girl. The child sees candy and asks the parent if she can have some. The parent ignores this or says "no." Perhaps the child escalates a little and begins to whine, cry, or tug at the parent's clothing, crying out loudly and persistently, "I want some candy!" The parent (who perhaps has only read up to Chapter 2 of this book) then says, "All right, here's the candy," and hands the child a candy bar from the rack. Where is the positive and negative reinforcement? The child's whining, tugging at the parent, and repeatedly insisting on candy (the behavior) was associated with a positive consequence (candy). That is positive reinforcement of the child's behavior. The parent giving the candy to the child (the parent's behavior) was associated with the immediate termination of an aversive event (child whining). That is negative reinforcement of the parent's behavior.

Such combinations of positive and negative reinforcement are common in everyday situations without the mild drama of a grocery store tantrum. Consider parents sitting in the living room chatting and their infant begins to cry loudly from his or her crib. The father goes into the room and picks up the infant. As soon as he does that, the infant stops crying. At this point, the infant, who happens to be unusually bright and amazingly verbal, looks up to his father and says, "Dad, you picked me up after I cried—that is positive reinforcement because my behavior (crying) was followed by a consequence (being picked up, cuddled, patted, and held). Thanks Dad!" The Dad says, "Mildredina (daughter's name), no need to thank me. The noise from your crying was, well, pretty aversive for us. When I picked you up, the noise ended right way. That is negative reinforcement because my behavior (picking you up) terminated the noise." (Of course, at this point, the mother interjects and correctly notes, "Remember, both of you, this is not reinforcement unless the likelihood of the behaviors you mentioned increase in the future. Now good night!") This arrangement conveys how both positive and negative reinforcement can be operant in similar situation but for different people.
In social interaction, the response of one individual is sometimes negatively reinforced because it terminates an aversive behavior initiated by another individual. At the same time, the aversive behavior of the other individual may be positively reinforced. This can be seen in more frightening interactions such as being mugged or robbed. Positive and negative reinforcement occur when the victim of an aggressive act such as physical assault complies with the wishes of the aggressor (giving up his wallet) in order to terminate an aversive situation. Unfortunately, the act of compliance of the victim positively reinforces the aggressor, increasing the probability of future aggression by the aggressor.

**Punishment**

Punishment is the presentation or removal of a stimulus or event after a response, which decreases the likelihood or probability of that response. This definition is somewhat different from the everyday use of the term. In everyday life, punishment refers to a penalty imposed for performing a particular act. For example, misbehaving children are “taught a lesson” by undergoing pain, sacrifice, or loss of some kind (slap, harsh reprimand, loss of a privilege). Criminals may receive penalties (fines, probation, incarceration) based on the acts they have committed. Yet, punishment in the technical sense is defined solely by the effect on behavior. The above examples, although called punishment in everyday life, might not have any effects on the likelihood of future behavior. In behavior modification, punishment is operative only if the likelihood of the response is reduced, that is, a punishing event is defined by its suppressive effect on the behavior that it follows.

In behavior modification, punishment is de-emphasized for a host of reasons discussed in detail later. When punishment is used, it does not necessarily entail any pain, physical coercion, or many of the demeaning, humiliating, and outright nasty consequences provided in everyday life. Indeed, grabbing, hitting, and shaking that parents or teachers may do with young children in everyday life would not be used in behavior modification.

There are two main types of punishment. In the first type, an aversive consequence is presented after a response. The numerous everyday examples of this type of punishment include being reprimanded or slapped after engaging in some behavior. (These examples convey the sequence of events: behavior followed by a consequence. However, it is not likely that they actually influence the likelihood of behavior in the future, given the way they are used, as discussed later in this chapter on punishment.) The second type of punishment is the removal of a positive event after a response. Examples include losing privileges after staying out late, losing money for misbehaving, being isolated from others, and having one’s driver’s license revoked. In this type of punishment, some event is taken away after a response has been performed.

Punishment and negative reinforcement are often confused even though they are very different. The key difference is that reinforcement, whether negative or positive, always refers to procedures that increase behavior, whereas punishment refers to procedures that decrease behavior. In negative reinforcement, an aversive event is removed after a response; in punishment, an aversive consequence follows a response.
**Extinction**

Extinction is an important principle of operant conditioning not represented in Figure 2-1. Extinction refers to the cessation of reinforcement of a response that results in a
decrease in the likelihood or probability of the behavior in the future. As with the other principles, extinction is defined by the relation of a response to consequences and to a change in the likelihood of behavior in the future. No longer reinforcing a response results in the eventual reduction or elimination of the response. It is important to keep this procedure distinct from punishment. In extinction, a consequence that was previously provided no longer follows the response. An event or stimulus (money, noise) is neither taken away nor presented. In punishment, some aversive event follows a response (a reprimand) or some positive event (money) is taken away.

In everyday life, extinction often takes the form of ignoring a behavior that was previously reinforced with attention. A parent may ignore a child when the child whines—this is extinction if the parent had been attending to the behavior (the reinforcer) on prior occasions but no longer does so. A teacher may ignore children who talk without raising their hands, assuming they previously were called on when they shouted out. A therapist or counselor may ignore certain self-defeating statements made by the client rather than attending to them. In each of these examples, the reinforcer (attention, approval, or sympathy) previously provided for the response is no longer presented.

In everyday life, extinction may contribute to behavioral problems, as well as ameliorate them. Often, desirable behavior is accidentally extinguished. For example, parents sometimes ignore their children when the children are playing quietly and may provide abundant attention when the children are noisy. This may extinguish quiet play and positively reinforce noisy play. Merely reallocating parental attention so that it follows appropriate play is often sufficient to develop appropriate behavior and to extinguish inappropriate behavior.

Cessation of attention is not the only example of extinction. For example, putting money into vending machines (a response) will cease if the reinforcer (cigarettes, food, or drink) is not forthcoming; turning on a radio will cease if the radio no longer provides sound; and attempting to start a car will cease if the car does not start. In each of these examples, the consequences that maintain the behavior are no longer forthcoming. The absence of reinforcing consequences reduces the behavior.

Extinction can be used as a technique to reduce or eliminate behavior. However, the events that reinforce behavior must be identified so that they can be prevented from occurring after the response. For example, a frustrated elementary school teacher may decide that he or she will no longer look at the class or pay attention to the children when they are talking to each other. The teacher may look down at the floor or turn away from the class with the idea and hope that his or her attention is maintaining the children’s disruptive behavior. This is an example of ignoring the behavior. However, this may not be extinction or lead to behavior change. The reason is that much of disruptive behavior in the classroom is maintained by the attention of one’s peers (making faces, making comments back to each other, smiling, throwing items). If these are the reinforcers, only their cessation would be likely to result in extinction. The key point is two-fold. First, although extinction often includes ignoring, not all ignoring necessarily qualifies as extinction. For extinction to be operative the reinforcer that has previously followed behavior is no longer presented, and the likelihood of the behavior.
decreases as a result. Second, for extinction to work, one must identify the reinforcer maintaining behavior.

**ADDITIONAL PRINCIPLES AND CONCEPTS**

The above discussion examined antecedents, behaviors, and consequences. Separating these for discussion is useful for presentation, but of course, they are all combined in programs designed to develop behavior. As reinforcement, punishment, and extinction are elaborated in later chapters, how all of the concepts are combined to change behavior will be illustrated further. There are a few additional concepts that are important to highlight to explain how behavior develops and is maintained.

**Discrimination**

Discriminative stimuli were mentioned in the discussion of antecedents that control behavior. Stimuli associated with reinforcement, when present, increase the likelihood of the behavior. When behavior is performed in the presence of some stimuli ($S^+$) but not in the presence of others ($S^-$), the individual is said to have made a discrimination, and behavior is said to be under stimulus control. Discrimination refers to the fact that the individual responds differently under different stimulus conditions. Discrimination and stimulus control are almost always operative in behavior modification programs. Programs are conducted in particular settings (e.g., the home) and are administered by particular individuals (e.g., parents). Insofar as certain behaviors are reinforced or punished in the presence of particular individuals or certain environmental cues and not in the presence of other stimuli, the behaviors will be under stimulus control. In the presence of cues associated with the behavior modification program, the client will behave in a particular fashion. In the absence of those cues, behavior is likely to change because the contingencies in new situations are altered.

A familiar example of discrimination and stimulus control that may arise in a behavior modification program pertains to the behavior of students when the teacher is in the classroom. As most of us recall from elementary school years, the amount of disruptive behavior often varied depending on whether the teacher was in the room enforcing the rules of the classroom. Once the stimulus (teacher) associated with the reinforcing or punishing consequences was no longer present, behavior often deteriorated. Indeed, the stimulus control that individuals such as parents and teachers exert over behavior often creates a problem in behavior modification. The children may perform the responses in the presence of parents or teachers but not in their absence. Special contingency arrangements are often needed to ensure that the desired behaviors transfer to new people, situations, and places.

The control that different stimuli exert over behavior explains why behavior often is situation-specific. Individuals may behave one way in a given situation or in the presence of a particular person and behave differently in another situation
or in the presence of another person. Because different reinforcement contingencies operate in different circumstances, individuals can discriminate among the stimuli that are likely to be followed by reinforcement.

People make discriminations across a variety of situations for most behaviors. For example, eating habits probably vary, depending upon whether one is at home or in a restaurant. At home, it is more likely that people will place crumpled napkins, books, elbows, and feet on the table when they eat meals; these behaviors are much less likely in a restaurant (with the possible exception of a few of my relatives). Similarly, further discriminations are made, depending on whether one is eating in an elegant or a fast-food restaurant. Numerous other variations in behavior are evident because of differences in the situations and the contingencies associated with them.

**Generalization**

The effect of reinforcement on behavior may either extend beyond the conditions in which training has taken place or extend to behaviors other than those included in the program. The ways in which effects of the program may extend beyond the contingency are referred to as generalization.

**Stimulus Generalization.** *Stimulus generalization refers to the generalization or transfer of a response to situations other than those in which training takes place.* Stimulus generalization occurs if a response reinforced in one situation or setting also increases in other settings (even though it is not reinforced in the other settings). Generalization is the opposite of discrimination. When an individual discriminates in the performance of a response, this means that the response fails to generalize across situations. Alternatively, when a response generalizes across situations, the individual fails to discriminate in his or her performance of that response. Often when a behavior is reinforced in one situation or in the presence of one set of conditions, it may be performed in new situations that are similar, even if reinforcement is not provided in those situations.

Figure 2-2 illustrates stimulus generalization. S1 refers to the stimulus condition or the situation in which the response is reinforced. R1 refers to the response or the behavior that is reinforced. The figure shows that the trained response (R1) is performed across a variety of stimuli or situations (S2, S3, S4, S5). The degree of stimulus generalization often is a function of the similarity of new stimuli (or situations) to the stimulus under which the response was trained. Of course, over a long period, a response may not generalize across situations because the individual discriminates that the response is reinforced in one situation but not in others.

Examples of stimulus generalization are common in everyday experience. For example, a child may talk about certain topics in the presence of his family because talking about those topics is reinforced (i.e., discussed freely, attended to) among family members. The child may also discuss the same topics in the presence of guests. In that case, the child's behavior (talking about certain topics) has generalized across situations. Parents may show considerable embarrassment when
children freely discuss family secrets or personal topics (e.g., how one's father puts on his toupee or how a parent looks in the shower). Generalization is also readily apparent when a child responds to a teacher in a fashion similar to the fashion in which he or she responds to a parent (in the expression of affection). To the extent that a child sees parents and teachers as similar, the stimulus control exerted by parents will be shared by the teacher. Because the antecedent events (approaches by the adult, expressions of affection) and the consequent events (hugs, kisses) are different for the child in relation to teachers and parents, the child quickly learns a discrimination. Consequently, expressions of affection are more likely in the presence of parents ($S^p$) than of teachers ($S^t$).

Stimulus generalization represents an exceedingly important issue in behavior modification. Invariably, training takes place in a restricted setting such as a classroom, a home, a hospital ward, or an institution. It is desirable that behaviors developed in these settings generalize or transfer to other settings. There are many procedures to ensure that behaviors transfer from one setting to another, and these are discussed later.

**Response Generalization.** Another type of generalization involves responses rather than stimulus conditions. Response generalization refers to the changes in behaviors or responses other than those that have been trained or developed. Response generalization occurs if a specific response is developed through reinforcement or other procedures and this systematically alters other behaviors that have not been directly trained.

Altering one response can inadvertently influence other responses. For example, if a person is praised for smiling, the frequency not only of smiling but also
of laughing and talking might increase. This is referred to as response generalization. Response generalization is depicted in Figure 2-3, where $S_r$ refers to the stimulus condition in which training of a response takes place and $R_r$ refers to the response that is reinforced. Although only one response is trained in the situation, a variety of other related responses ($R_c$, $R_b$, $R_k$, $R_d$) may also be performed.

Examples of response generalization are plentiful. For example, according to one report, attending noncompliance (not completing the requests of adults) in four children also decreased such inappropriate behaviors as aggression (pushing, hitting, biting), disruption (whining, crying, screaming), property destruction (pushing, kicking furniture, pounding on or throwing objects), and the placing of indecent objects in their mouths (Parrish, Cataldo, Koll, Neef, & Egel, 1986). The intervention, based primarily on variations of positive reinforcement, effectively increased compliance among these children. Interestingly, when their compliance increased, their aggression, disruption, and other inappropriate behaviors decreased, even though these latter behaviors were not the focus of the intervention.

The notion of response generalization is often used to explain changes in responses other than the target response. The concept is based on the view that the effects of an intervention will generalize from one response to other responses that are similar in some way. Technically, the term response generalization may not be accurate for two reasons. First, responses that are not supposed to be focused on may inadvertently receive reinforcing consequences. For example, a child praised for studying in class may improve in reading, even though reading may not have been the response to which the reinforcing consequences were directed. Although this may be spoken of as generalization, it may reflect the direct operation of reinforcement and not be generalization at all. When a child is praised for paying attention, he or she may be reading on some of the occasions that reinforcement is delivered. Thus it is difficult to speak of response generalization, because the behavior was directly reinforced.

There is a second, slightly more complex reason that response generalization may not accurately account for the many changes that occur with treatment. Response generalization refers to changes in behaviors that are similar to the target behavior. Yet change in one behavior (studying) often is associated with changes in other behaviors (socializing, complying with requests) that appear to have no direct relation or resemblance to the target behavior.

The tendency of responses to change together or as a cluster has been referred to as response association. This is a descriptive term that merely notes that behaviors change together, that is, they co-vary. Which behaviors change can be predicted by knowing what other behaviors are in the cluster (Waller, 1975). Response generalization as a concept has emphasized that changes occur in behaviors that are similar to those that are altered directly. Although changes in similar responses may occur, this does not explain the breadth of changes that may result. A key point from the standpoint of behavior modification is to note that changes are likely to go beyond the specific behavior one is focusing on in treatment.

In behavior modification, the concepts of stimulus and response generalization are ordinarily used to denote that changes occur across various stimulus condi-
Response generalization: Reinforcement of one response (R₁) in a given situation (S₁) may result in an increase of other responses (R₂, R₃, R₄, R₅).

SUMMARY AND CONCLUSIONS

The principles outlined in this chapter provide the basis for most of the operant conditioning programs in applied settings. The principles describe basic relations between antecedents, behaviors, and consequences and account for diverse treatment interventions. Settings (situations, contexts), prompts (cues or guides that help initiate the response), and discriminative stimuli (Sₒ) are key antecedents that influence development of behavior. Behaviors that are altered may include a specific response that is developed or a sequences of multiple responses. Shaping was mentioned as a key concept to reinforce approximations to attain terminal behaviors that may not be in the individual's repertoire. Forward and backward chaining were discussed as ways of building sequences of several behaviors.

Consequences for behavior rely heavily on reinforcement, punishment, and extinction. Reinforcement always refers to an increase in the likelihood of the behavior in the future when consequences are contingent on that behavior.
Punishment refers to a decrease in the likelihood of behavior when consequences are contingent. Extinction consists of no longer providing a reinforcer that previously was provided for the response and is also associated with a decrease in behavior.

Discrimination and generalization were also discussed. Discrimination refers to responding differently across different situations or circumstances. Individuals learn to respond differently to various situations through differential consequences such as reinforcement. Behaviors reinforced in one situation but not in another tend to be performed in the former situation but not in the latter. Generalization refers to responding similarly across different situations (stimulus generalization) or changes in many behaviors other than those that are directly focused on in the intervention (response generalization or response covariation).

Many principles were introduced in this chapter. The purpose was to provide an overview of key concepts that form the building blocks of interventions. The concepts, the many procedures that follow from them, and how these are implemented in special ways to be effective are elaborated in later chapters.

**KEY TERMS**

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<th>ABCs</th>
<th>Extinction</th>
<th>Generalization</th>
<th>Prompts</th>
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<td>Chaining</td>
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<td>Establishing operation</td>
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**APPLYING PRINCIPLES AND TECHNIQUES TO EVERYDAY LIFE**

1. Antecedents, behaviors, and consequences occur as sequences in daily life and social interaction. Consider the behavior of someone in your life (a friend, roommate, peer, partner, relative) that involves social interaction such as talking, dancing, or spending time together. In some part of the interaction, identify what might be an antecedent condition of the other behavior (what he or she says, does, or looks), the behavior on your part that this evokes, and the consequence of your behavior (how the other person responds). Give an example from your experience that reflects such an interaction and note the antecedent, behavior, and consequence.

2. Describe how you might use prompts and shaping to develop a behavior in a friend or relative. Assume that the behavior is engaging in an exercise of some sort. The goal is to achieve 20 minutes of some exercise at least 3 days a week.
Use at least two different types of prompts. How would you prompt, shape, and reinforce behavior? Be as specific and concrete as you can.

3. Describe a situation in which positive and negative reinforcement are evident. Remember the example in the chapter in which the parent attended to a crying infant in which the child's crying was positively reinforced and the parent's picking up of the child was negatively reinforced. Think of another example like that. Identify precisely what behavior is positively reinforced and what behavior is negatively reinforced.

4. An acquaintance or friend is approaching you. Think of two different ways the person looks and describe them. What about the way the person looks is an S1 indicating that your positive comments will be reciprocated (positively reinforced)? What about the person is an S1 that would indicate to you that positive comments are not likely to be reciprocated?

5. What would be two examples of extinction of behavior? Consider a behavior in which you engage in every day, such as interactions with others, and another behavior of a friend or acquaintance.

FOR FURTHER READING


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NOTES

1. Discussion of the principles introduces several new terms. To aid the reader, major terms and their definitions are italicized when they are first introduced. Also, a glossary at the end of the book provides a summary definition of the major terms that arise in this chapter and throughout the text.

2. Pain and punishment are inextricably bound in language and thought, despite their lack of relation in behavior modification. Indeed, the word pain can be traced to Latin and Greek words for punishment and penalty.
3. Occasionally the terms *positive* and *negative punishment* are used to distinguish whether an event is presented (reprimand) or is withdrawn (loud noise) after behavior. This is not a common practice in part because juxtaposing the terms "positive" with "punishment" seems like an oxymoron because of the nontechnical use of the word "positive" as something "good." In behavior modification, positive and negative refer to presentation or withdrawal respectively rather than the subjective value of something.