Chapter 2

Designing Effective Strategies of Change: Essential Building Blocks

Goals

- 1. Define and distinguish among behavior, learning, and teaching.
- 2. Define and illustrate operant or response class and the three-term contingency.
- 3. Define, illustrate, and differentiate behavioral principles and procedures.
- 4. Define and distinguish among environment, stimulus, and stimulus class.
- 5. Define and illustrate:
 - a. unconditioned (or unconditional) respondent behavior
 - b. conditioned (or conditional) respondent behavior
 - c. unconditioned stimuli
 - d. conditioned stimuli
 - e. respondent or classical conditioning
- 6. Differentiate as to when to use the verbs *elicit* and *evoke*.
- 7. Define operant behavior and operant learning.¹
- 8. Define and illustrate:
 - a. contingencies
 - b. reinforcement
 - c. positive reinforcement
 - d. negative reinforcement
 - e. extinction
 - f. punishment
 - g. positive punishment
 - h. negative punishment
 - i. stimulus control
- 9. Define and illustrate three types of stimulus control stimuli.

¹Some use the term *operant conditioning* instead; we prefer to avoid that usage because of the potential confusion between operant and respondent processes, which are quite different.

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- 10. Define, illustrate, and differentiate *stimulus discrimination* from *stimulus generalization*.
- 11. Define, illustrate, and differentiate motivating operations and stimulus control.

Mr. Straus has asked his students to read a few pages of *The Catcher in the Rye*. A star student, Ahmad, shares his especially insightful analysis of the hero's character. Mr. Straus hopes to capitalize on this teaching moment, but doesn't know how. He doesn't want to risk singling Ahmad out as someone he favors, yet would like to draw the other students' attention to the boy's excellent analysis. How should he proceed?

While visiting her mom in the hospital, Vera is dismayed to see a staff member shifting from caring for her mom's roommate, suspected of having a communicable disease, to adjusting Mom's breathing apparatus. "For heavens sake! Aren't you going to wash your hands?" What might the hospital do to prevent such risky situations?

His mom grabs Stevie's hand just as the three-year-old is about to put a ladybug in his mouth. Stevie responds by producing a major meltdown: kicking, screaming, and flailing about. What is his mother to do?

Each of the previous examples represents the kinds of behavioral challenges any of us might be called upon to address in the course of our every-day lives. Behavior analysts are trained to handle situations like these, along with a myriad of others involving what people say or do. In Chapter 1 we defined *applied behavior analysis* (ABA). In this chapter, we begin by introducing you to and illustrating a set of fundamental concepts and terms you will encounter as you explore what learning and behavior are about and how they are altered.

WHAT IS BEHAVIOR?



"Behavior is what an organism is doing; or more accurately what it is observed by another organism to be doing" (Skinner, 1938, p. 6).

Given that the central theme of this text deals with changing or modifying behavior, we must first define the term. As described in Chapter 1, when we talk about **behavior**, we are referring to *what any organisms (including people) say or do.* Chirping, poking food into a nestling's mouth, writing, cursing, walking, crying, answering questions, hugging, solving math equations, spitting, smiling, reciting a poem, describing, imagining, or visualizing a picture or writing a term paper are all instances of behavior.

Behavior implies action. So labels, states, or personal characteristics like happy, sad, and alert are not included. But chirping, mating, striking someone, crying, and smiling are behaviors. Behavior analysts are not concerned with describing organisms' appearance, inner drives or personality traits. Rather, their focus is on people's (or animals') actions (both physical and verbal) and the functions of those acts. A behavior analyst would not say "Dexter is lazy;" but might comment that he frequently fails to complete his work. Calling Paula a procrastinator would be inappropriate, but commenting that she regularly delays completing her assignments until the last moment would be an acceptable way to describe her pattern of performance. We would not identify Bruno as a prodigy, although we might say he plays the piano extremely skillfully. We do not label Lucretia as a rotten little kid, but describe the child's *actions* as frequently hitting other children and grabbing their toys. Viewing problematic situations in terms of what people *do*, rather than what they *are*, opens the possibility of change, because while we cannot alter who people *are*, we might be able to help them change the way they act by assisting them to increase, decrease, expand, refine, or learn new or different response patterns.

WHAT IS LEARNING?

Learning consists of altering behavioral or response patterns, generally as a function of changes in environmental conditions. Stated even more simply: We only know if learning has occcurred if there has been a change in behavior. The way we know an organism has learned something new is by observing changes in patterns of behavior in relation to particular environmental events: While new on the job, Melba, the bank teller, generally used to open her interaction with a customer with "Yeah?" while looking off into the distance. After participating in a customer service training program and receiving intermittent supervisory feedback, now whenever a customer approaches, she regularly smiles, looks directly at, and greets the person with a phrase such as "How may I help you?" We could say that Melba has *learned* how to greet her customers in a friendly, helpful way.

WHAT IS TEACHING?

If we accept the notion that *learning* is a relatively enduring change in behavior that occurs as a function of changes in environmental conditions, then a reasonable definition of **teaching** is *promoting learning by any or a combination of various means*: showing, telling, guiding, and most important of all for educators, differentially reinforcing or otherwise arranging matters so that reinforcers follow a reasonable portion of those efforts that are directed toward meeting particular behavioral objectives (see Chapter 4). Parent birds do that by herding their fledglings to locations where food is available. Human parents and teachers choose a suitable environment and provide the kind of assistance that will enable the learner to succeed. Managers, trainers, supervisors, peer tutors, religious leaders, philosophers, politicians, editorial writers, lecturers, and many others may perform this intentional teaching function. Informal or even unacknowledged teaching goes on as well, as when the actions of peers, parents, family members, celebrities, and the wealthy and powerful serve as models for others to imitate, perhaps yielding comparable reinforcement to individuals in the process.

As all of us know, however, there is the act of *teaching*—playing the teaching role—and there is effective teaching-performance that functions to produce student learning. The act of teaching runs the gamut from being really effective to tragically inefficient or even counterproductive. Why do some students become enamored of their subjects while others consider them a nuisance? How is it that some trainees become proficient at certain skills, while others remain incapable of performing the task at hand? Certainly, native physical and intellectual attributes and deficits play a role, but the manner in which the environment supports efficient and successful behavior change matters a great deal. Here is where applied behavior analysis makes its entrance. ABA is designed to capitalize on the ever-growing body of knowledge about learning and behavior by effectively applying procedures based on behavioral principles for the purpose of promoting functional, ethically sound and enduring behavior change.

HOW DOES BEHAVIOR ANALYSIS WORK?

Behavior analysis operates by breaking "...complex behavior down into its functional parts. A successful analysis should allow the behavior to be synthesized by putting the parts back together" (Catania, 2013). To accomplish such a lofty purpose, behavior analysis restricts itself to actions that can validly and reliably be observed and recorded, either by the person engaging in the behavior or by others. For example, engaging in "self-talk" would be considered behavior only if instances of "self-talk" could be validly recorded—as in using a voice recorder or a written narration to chronicle what the person is saying in the absence of any audience. (For a more detailed elaboration of the concept of behavior, refer to basic operant learning texts: Catania, 2013; Johnston & Pennypacker, 1980, and Skinner's historically important 1938 text.)

In practice, the terms behavior and response tend to be used somewhat interchangeably and are usually reserved for specific instances of activity. However, different responses or behaviors often produce similar results under similar circumstances. When this occurs we refer to these behaviors as belonging to an operant class (sometimes called response class): "the composite set of behaviors that result in a single type of reinforcing event" (Ferster & Skinner 1957). For example, when a baby cries or fusses, the crying or fussing are each specific behaviors. However, when the baby cries or fusses when hungry and then gets fed, the crying and fussing become part of the same operant class, in that they tend to produce the same reinforcer. When we talk about "going to the store," the operant class might include walking and/or bicycling or driving. If our concern is with changing Johnny's "aggressive behavior," we actually are referring to changing the operant class that includes Johnny's throwing objects, kicking, or shouting when ignored, because in the past all of these have produced his mom's attention. Unsafe responses such as failing to put on protective equipment and omitting other safety precautions when in a hurry to get home for dinner fall within the same operant class: risky behavior; but refusing to use safety goggles because they distort the worker's vision and taking shortcuts to be able to leave work earlier are members of two different operant classes, because they produce different reinforcers.

Similarly, suppose two different things are happening when we coach Mary to say "milk" and provide her with milk as a consequence, versus when we attempt to teach her to say "milk" by holding up a picture of a glass of milk and ask Mary to tell us the name of the picture. (Later you will learn that the first instance of saying "milk" is called *manding* and the second is called *tacting*; see Chapter 19.)

Generally, in ABA our goal is to change **operant** or **response classes**: the composite set of behaviors that result in a single type of reinforcing event (saying 'please;' holding out one's hand, raising one's eyebrows while tilting one's chin), rather than one specific form or topography of a behavior. We need to remind ourselves to view both the specific set of responses that compose an operant class, along with the reinforcing *function*, or purpose, of any of the responses constituting the class. (See Figure 2.1 and Chapters 9 and 10 for more information related to function, especially the function of unwanted behavior.)

When we add the *function* of a response to the formula, we can be said to be addressing the **A-B-Cs** of behavior analysis,¹ or speaking more technically, we are referring to a *three-term contingency*. The expression **three-term contingency** connotes *the interdependency among the antecedent conditions (A), the behavior (B), and the consequences (C)*. For example: a picture of a dog, an actual dog, or the word "dog" (A) can all set the stage for the response "dog" (B), which then is followed by praise, confirmation or some other form of acceptance (C).

¹We thank Aubrey Daniels for introducing the A-B-C terminology.



Figure 2.1 Illustrative response class

Behavioral Principles and Procedures

Note that in many of our examples we generally refer to clusters of antecedents. These antecedent clusters set the stage for particular operant classes, which in turn may consist of a number of functionally related responses. Now, we introduce two other important concepts: 1) principles of behavior (behavioral principles) and 2) behavioral procedures. A principle of behavior is a scientifically derived rule of nature that describes the enduring and predictable relation between a biological organism's responses and given arrangements of stimuli (objects and events that can influence behavior). Principles of behavior are discovered through careful scientific investigation.² When we technically apply behavioral principles for the explicit purpose of changing (shaping, teaching, modifying, managing) behavior we are engaging in behavioral analytic procedures.

A

Behavior analysts working in applied settings, such as schools, homes, businesses, manufacturing, service, health care, or civic organizations, turn their knowledge of behavioral principles into practices. These

practices are designed to influence performance in specific ethically-sound ways to teach new knowledge or skills, and/or to manage, motivate, support, sustain, or weaken particular behavior under given circumstances. To illustrate, let us look at how one practice is derived from the procedure we call "positive reinforcement." Positive reinforcement is defined by its function: that is, the operation is so labeled on the basis of evidence that it is responsible for producing an increase in the rate or probability of a behavior as a function of the frequency with which that behavior is reinforced. Recognizing the importance of the frequency of applying reinforcers enables practitioners to apply positive reinforcement more effectively to assist individuals to learn new skills such as using grammatical rules, adding columns of figures, strumming a guitar, assembling the parts of a product, saying "thank you," opening a door for someone, or (fill in the blank with respect to any given behavior you might want to change in your own life). The better informed about conditions that alter the effectiveness of positive reinforcement, the more efficiently practitioners can design successful behavioral procedures.

Consider an example: Deborah's toddler niece Fiona often refuses to share her toys with other children. Noticing that Fiona welcomes hugs and praise (choosing stimuli known to be effective under like conditions is one factor that makes reinforcement effective), Deborah hugs and praises Fiona copiously when the child shares her toys. Fiona now shares her toys with the other children more often while playing. In more technical terms, recognizing that the rate of behavior probably would increase if rapidly and frequently followed by reinforcers known to be effective under the circumstances, Deborah applied positive reinforcement, thereby encouraging Fiona to share her toys. Notice that Deborah didn't hug and praise Fiona every now and then, because Deborah knows that when you want to immediately increase a new behavior you need to reinforce every occurrence of the behavior until it is established. This is based on the understanding of the principles of reinforcement.

WHAT DOES THE TERM ENVIRONMENT MEAN?

Differentiating "Environment" from "Stimulus"

We label the physical and social **environment** in which a particular organism (in our case, usually a person), behaves as its *context*. Typically, the context in which an individual behaves generally is composed of multiple stimuli. Items and events abound within a classroom: desks, lights, books, other children, the teacher and their actions, and so on. Not all of those elements actually affect, or technically speaking, are *functionally related* to the *operant behavior* or *operant response class* (composite set of behaviors) of concern. For instance, the antecedent exerting the strongest influence over Mark's compliance might have been the fact that Mr. Brennan also is the football coach and Mark is

²The term *behavioral law* is occasionally applied when such relationships repeatedly occur both within and across species under all sorts of varying conditions.

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eager to make the team; whether the classroom seats are wooden or plastic, even people behaving, but not noticed, are irrelevant.

A stimulus, by contrast, is a specific event or combination of events (stimuli) that in some way affect(s) behavior. For example, in Mr. Brennan's classroom (the context or environment), Mark is instructed to complete his spelling exercise (an antecedent stimulus, because it directly precedes that particular response; see Figure 2.2). Mark complies with Mr. Brennan's request (the response or behavior). As a result (consequence), Mr. Brennan smiles and compliments Mark (the consequential stimuli).

Similar to regarding a complex behavior as composed of more than one simple operant (behavior), we recognize that reinforcing consequences also may vary in their levels of complexity. Mr. Brennan may compliment Mark for completing his assignment, affix a gold star to his paper or nod cursorily when the boy hands it in.

The antecedent or simultaneous stimulus, or stimuli, that set the occasion for the behavior might be part of a broader stimulus class: a group of stimuli that may vary across physical dimensions but that produce a common effect on an operant class (to paraphrase Pierce & Cheney, 2008). The instructions for a spelling exercise could be part of a larger stimulus class that includes any of Mr. Brennan's instructions. Other stimuli, perhaps a substitute teacher lacking the same potential function of inviting Mark to join the team, are excluded. In other words, Mark tends to comply when Mr. Brennan assigns a spelling exercise, regardless of who else is there, the color of the classroom walls, the weather or lighting conditions, and so on; while in Mr. Brennan's absence, Mark may not necessarily complete his spelling exercises, even if he is capable of doing so, despite all of the other present but nonfunctional stimuli (children, lighting, etc.).

Johnny hits his sister when his mother is in the room. Perhaps his mother and sister are members of a stimulus class composed of people whose attention is reinforcing to Johnny. So when his mother and sister are nearby, but inattentive, the occasion is set for Johnny to hit his sister. As you might imagine, Johnny's action has a good likelihood of producing what works as a reinforcer for him: his mother's and his sister's attention.

When his supervisor Pat and co-worker Jared pass by, Ned starts complaining about the production line. It is likely that both Pat and Jared are members of a stimulus class composed of people whose attention is reinforcing to Ned. So, especially after Ned has been working alone for a while, with-

An Exercise

Serena, the physician's assistant, is especially friendly (smiles, makes good eye contact, and produces an "upbeat" vocal tone) to anyone who smiles at her and/or addresses her by name. Can you identify the stimulus and operant classes in this situation?

vocal tone.

The stimulus class consists of being smiled at and being addressed by her name. The operant class consists of her smiling, making eye contact, and speaking in an upbeat



Figure 2.2 Interrelationship of the antecedent, behavior and consequence

out any social interactions, the occasion is set for Ned to complain when Pat and Jared show up. From past experience Ned has learned that complaining is apt to produce reinforcement in the form of attention from both Pat and Jared.

When analyzing operant behavior, you might view such stimuli as analogous to antecedent or discriminative stimulus classes, in the sense that they generally are composed of complex units functioning within the three-term contingency. In fact, it is hard to illustrate or talk about one without the other. To avoid confusion, when considering discriminative (antecedent) and reinforcing (consequential) stimuli within any three-term contingency, think about both operant classes and stimulus classes.³ Therefore, when you plan to analyze or modify behavior, remind yourself that applied behavior analysis is based on the assessment and modification of one or more components of the three-term contingency. Trusting you now recognize that often it is not a single stimulus, but actually a collection of stimuli that are affecting behavior, we now discuss how these stimuli exert such control or influence over behavior. Before we discuss conditioning related to the three-term contingency, we should elucidate the difference between respondent and operant conditioning.

RESPONDENT BEHAVIOR AND RESPONDENT CONDITIONING

Unconditioned respondent behaviors are those behaviors that are reliably elicited by particular stimuli despite any prior learning. Unconditioned respondents are also known as *reflexes* and generally thought of as behaviors with which the individual was endowed at birth. Particular preceding or antecedent stimuli directly "elicit" respondent behavior. Those eliciting stimuli are referred to as *unconditioned stimuli* (USs) and the responses those stimuli elicit are referred to as *unconditioned responses* (URs). Familiar examples of USs are a bright light shined into the eyes causing the pupils to contract (UR); an object touching an infant's lips (US) producing the response of sucking (UR); or a foreign object in throat (US) eliciting gagging (UR). The essential feature of an unconditioned reflex is that it does not depend on learning. The stimulus automatically elicits/produces the response. Many of these particular stimuli and their elicited responses have been assigned the term "reflex": the gag reflex, the salivary reflex, and so on. Although essentially all of us are born with the capability for emitting a broad set of specific unconditioned responses, we can acquire novel stimulus-response combinations through a process called *respondent conditioning*.⁴



The concept of respondent conditioning originally derived from Pavlov's work on the salivary reflex in dogs. In respondent conditioning (also referred to as *classical conditioning*), a new relation develops between a stimulus and a formerly unconditioned response. This takes

place when a neutral stimulus (NS)—one that does not automatically elicit a UR—is paired with a US, thereby producing a UR. As those pairings continue, the formerly neutral stimulus gradually acquires the eliciting properties of the US, eventually changing, thereby, into a conditioned stimulus (CS) capable of eliciting a response—the *conditioned response (CR)* much the same as the UR.

Pavlov found that dogs salivated when meat powder was placed in their mouths, in the absence of any prior learning. One might describe this phenomenon as "meat powder eliciting salivation." The meat powder was the unconditioned stimulus (US) and the salivation was the unconditioned response (UR). When, initially, Pavlov rang a bell (the neutral stimulus: NS), though, the dogs did not salivate. Yet, when Pavlov regularly paired the sound of the bell with delivery of the meat powder (NS + US), the sound of the bell began to acquire conditioned stimulus properties. After a number of those pairings, the bell alone elicited salivation, even when the dog received no meat powder. The bell became the CS; the salivation elicited by the bell, the CR (see Figure 2.3).

³Later you will discover the distinction between *operants* and *discriminated operants*.

⁴Although applied behavior analysts emphasize operant conditioning most heavily in their work, they do recognize the important role respondent conditioning can play in understanding and changing behavior.



Figure 2.3 Conditioning the sound of a bell to elicit salivation

Sometimes respondent conditioning has "survival value," as in the illustration above, but not always. For example, suppose as a result of an unrelated stomach virus (US), Margaret became nauseated (UR) immediately after eating spinach salad (NS). Perhaps the next time Margaret went out to lunch, just the sight of the spinach salad (CS) caused her to become nauseated (CR). Respondent conditioning may have been to blame.

It is important to note that just as a NS can become a CS, repeatedly presenting the CS in the absence of the US can eventually lead to the conditioned stimulus losing its eliciting effect. So with respect to Margaret becoming nauseated at the sight of spinach salad, were she determined to overcome her conditioned aversion toward the greens, she might consume tiny quantities of the salad as a first step. Assuming she continues those trials while remaining healthy, and continues to add larger and larger portions over time, eventually the spinach would no longer elicit the CR: the feelings of nausea. Actually, the acquisition of "irrational fears" of formerly neutral stimuli, [e.g., fear of spiders (arachnophobia), of large open spaces (agoraphobia) or enclosed spaces (claustrophobia), and/or various other conditioned phobias] may sometimes occur similarly. For many years behavior therapists have successfully used a practice called "desensitization," analogous to the method described above, to help "cure" clients' of irrational phobias by diminishing the adverse impact of the conditioned stimulus (e.g., Walker, Hedberg, Clement, & Wright, 1981). See numerous other examples in Behavior Therapy and other clinical psychological and psychiatric journals.).

In the case of respondent conditioning, the key focus is on antecedent stimuli functioning as "elicitors," "causes," or "producers" of behavior. (Figure 2.4 illustrates this relationship.)

In respondent behavior, responses are often said to be "involuntary" in the sense that the antecedent stimulus essentially generates or produces the response. With operant behavior, however, antecedent stimuli are *not* said to elicit a response because no particular antecedents are essential precursors to the response. Rather, the antecedent stimuli (A's) work only as a result of the individual's having experienced a history in which those stimuli immediately preceded or accompanied the reinforced behavior. In such instances, the antecedents are said to *set the occasion for* the particular behavior, as you will learn next.

OPERANT BEHAVIOR AND OPERANT LEARNING (CONDITIONING)⁵

Operant responses differ from reflex responses and are not said to have been elicited⁶ by preceding stimuli. Rather, the probability of their occurrence is controlled by stimuli that follow the behavior, (often

⁵You will find the term *conditioning* used sometimes in this text when we discuss operant learning because the BACB's Task List uses it. However, the term conditioning has become so closely associated with Pavlov and respondent behavior that *operant learning* is replacing the term *operant conditioning*. "The term operant conditioning is becoming obsolete" (Catania, personal communication, 2018).

⁶ We use the term "evoke" or "occasion" for operant behavior, "elicit" for respondent behavior.

Before conditioning: Spinach salad → (ill effect)
Conditioning experience: Becomes nauseated after eating spinach salad. Eats spinach salad → Stomach virus (US) → Nausea (UCR)
After conditioning experience: Becomes nauseated by eating or maybe even seeing a spinach salad.
Sees or eats spinach salad (CS) → Nausea (CR)

Figure 2.4 Conditioning an aversion to spinach salad

in the presence of a given stimulus or stimuli). The future rate of the behavior is a function of its previous learning history. Moreover, the way the consequence relates to the antecedent stimuli usually defines the operant. So we can analyze the threeterm (A-B-C) contingency by identifying the way the antecedent(s) or "A(s)" are related to the "B," the behavior, and the "C," the consequence. Thus, contingency refers to the specified dependencies or relations between behavior and its antecedents and consequences. (As we shall see later on, contingencies may be intrinsic features of environments, or they may be deliberately arranged, as in cases of teaching, training, preaching, convincing, managing, and so on. When behavior analysts intentionally present, withdraw, or withhold stimuli for the explicit purpose of affecting behavior, they refer to such actions as procedures.) In ABA, our concern generally is with modifying operant behavior. Therefore, the remainder of this chapter is devoted to explaining the basics of operant behavior.

THE "C" IN OPERANT LEARNING (CONDITIONING)

We begin by discussing the end of the three-termcontingency because change depends on the consequences of the behavior, including positive or negative reinforcement, extinction, punishment, timeout from reinforcement, and others. Without consequences, response patterns will not change in any lasting way. While antecedents also exert a powerful influence on behavior, first they need to gain their influence through consequences (i.e., reinforcement, extinction, or punishment). Baby cries and is fed or cuddled or changed. Baby learns to cry more often under particular circumstances, and as most new parents know, sometimes those antecedents remain a complete mystery to them.

Positive and Negative Reinforcement Defined and Illustrated

In its broadest sense, the term reinforcement often is used both as a name for how behavior changes (e.g., "She increased the number of reports she completed on time. I suspect some kind of reinforcement is at work."), or as a name for the contingencies or procedures that cause an increase or persistence in the probability of occurrence of a given response (e.g., "We used a reinforcement procedure consisting of delivering complimentary notes when she handed in her reports on time."). The term reinforcement can be separated into two categories: 1) positive reinforcement and 2) negative reinforcement. In positive reinforcement, the organism gains a stimulus, dependent or contingent on a response, resulting in the rate of that response increasing or maintaining (e.g., praising your husband for taking out the trash, leading to an increase in how frequently he takes out the trash).

Negative reinforcement (read this carefully, the terminology gets tricky here) occurs when a *stimulus is subtracted contingent on a response*, also *resulting in the subsequent rate of that response increasing or maintaining*. (For example, you nag your husband to take out the trash and stop the nag-

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ging once he takes it out. Afterward, he starts taking the trash out more often to avoid your nagging). The important thing to remember is that regardless of whether a "reinforcing" stimulus is presented (praise in the above example), or an "aversive" stimulus is removed (nagging in the above example), reinforcement functions to increase or maintain behavior (trash gets taken out more often in the above example.) It is not the nature of the stimulus, but its effect that matters. The operation-that it is either presented (added, plus = positive) or removed (subtracted, minus = negative) earns the procedure its title. Sometimes the distinction is confusing. Does a drink of water function as a reinforcer because the water has been *presented* or because it reduces the stimulus characteristics of a dry mouth? (We provide a more detailed explanation of reinforcement in Chapter 5 and specific methods for transforming neutral stimuli into reinforcer in Chapter 6.) Moreover, if a particular operant behavior continues, we assume it is reinforced at least some of the time. Conversely, as you will learn, if you want behavior to decrease, the (conceptually) simplest way is to make sure the behavior no longer generates reinforcement.

Extinction, Positive Punishment, and Negative Punishment Defined and Illustrated

The rate of a behavior tends to decrease when it no longer produces reinforcement (i.e., *extinction*), or when it is *punished*. Technically, the extinction operation is the discontinuation (cessation) of reinforcement as a consequence of a given behavior, leading to a *decrease* in the frequency of that behavior. (Again, the vocabulary can apply either to the change in behavior, e.g., "*her tantrums extinguished*" or to the conditions that led to the change, "*her tantrums were placed on extinction*.")

Consider an example: Logan asks for a candy bar every time he and his mother wait on the checkout line at the grocery store. When she tells him "No," he flops down on the floor, kicks his feet, and screams. His mom asks him to stop, but he doesn't. So she gives him the candy bar. Logan stops screaming (which positively reinforces Logan's tantruming, but negatively reinforces Mom's giving him the candy bar). Subsequently, whenever on line together and Logan asks for a candy bar but his mom refuses, he immediately tantrums until he gets the candy. Thus, we can assume Logan's tantrums are being reinforced by his mom's giving him the candy bar as a consequence of his misbehavior.

Suppose Logan's mom were to ask you to help decrease Logan's tantrums. You might suggest an extinction procedure, advising her to stick to her guns and refrain from giving him the candy bar when he starts screaming and kicking. Discontinuing the reinforcer, that is, no longer giving him the candy bar during or shortly after the tantrum, eventually should result in Logan's no longer throwing tantrums under those conditions. In that case, we might conclude that the tantrums have undergone extinction. (Chapter 27 elaborates on the use of extinction as a form of behavioral intervention.)

Punishment is another way to reduce the rate of an unwanted behavior. Like reinforcement, punishment can be broken into two separate categories: positive punishment and negative punishment. In positive punishment, the individual receives a (typically unpleasant) stimulus contingent on a response, resulting in a decrease in the future probability of that response. By contrast, in negative punishment, the individual loses a desirable stimulus contingent on a response. In both cases the future probability of the response decreases. If the coach tells a member of the water polo team that he is disappointed in him for skipping class (i.e., an outcome added as a consequence of skipping the class) and the boy does not skip class any more, we would say that positive punishment succeeded in lowering the probability of the boy's skipping class. On the other hand, if the coach takes away the boy's playing time for the next match (a loss of a pleasant stimuli) and then the boy no longer skips class, the coach has applied negative punishment. (See Chapters 30 and 31 for additional details on punishment.)

Again, the important thing to remember about the concept of punishment is that it results in a decrease in the behavior of concern. The addition of the qualifiers "positive" and "negative" simply refer to whether a stimulus was added/presented (positive), or subtracted/removed (negative), to produce

	Behavior Increases	Behavior Decreases
Stimulus Added	Positive Reinforcement	Positive Punishment
Stimulus Removed	Negative Reinforcement	Negative Punishment

Figure 2.5 A comparison of reinforcement and punishment operations

the particular response. See Figure 2.5 for a comparison of reinforcement and punishment operations.

Beyond noting the immediate consequences of a response, we need to remember that those consequences do not occur in a vacuum. Everyone's history is unique. Different people come to a given situation with diverse histories of reinforcement and/or punishment, and these histories influence what the person will do at any particular moment. Moreover, these individual histories can also affect what functions as a reinforcer or a punisher for any given person's behavior under particular conditions. We also need to recognize that reinforcer effectiveness is relative in the sense that it is not the person but rather the relation of the reinforced response and the response allowed by the reinforcer that is crucial: you can reinforce drinking with the opportunity to eat, or reinforce eating with the opportunity to drink, depending on the relative deprivations of food and water.

THE ROLE OF ANTECEDENTS ("A"s) IN OPERANT LEARNING

Antecedent Stimuli Defined and Illustrated

Earlier we described how operant behavior usually is set within a three-term contingency. Generally speaking, specific antecedent events or conditions affect behavior by either signaling the nature of the consequences for responding in a given way under those current circumstances, and/or, as in the case of motivating operations (abbreviated "MOs"), by affecting the potency of the consequence. When stimulus control develops naturally, we generally refer to it as a *process*; when it is programmed intentionally we are more apt to refer to it as a *procedure*. In either case, stimulus control is demonstrated when an antecedent stimulus is shown to gain control over one or more particular behaviors. (To the outside observer, it appears as if the stimulus "causes" the response.)

Next we describe three major types of discriminative stimuli (S^Ds):

- Those that often directly precede a reinforced response, and, thereby eventually come to signal the probability that a given response will be reinforced are labeled S^Ds Perhaps the sound of the lunch bell appears to cause the students to clean off their desks, but actually, having had a clean desk formerly resulted in their being allowed to go to lunch. These S^Ds are labeled positive discriminative stimuli (abbreviated S^Drs).
- Similarly acquired through the individual's learning history, the discriminative stimulus for extinction (S^A) *denotes an antecedent stimulus in the presence of which a particular response probably will not result in reinforcement*. Mrs. Mack places Jared's desk next to hers to ensure that he does not gain any extra attention from the other students when he acts silly. Mrs. Mack assumes her desk will become an S^A for acting silly, because should Jared act silly while sitting next to her desk, he gains no reinforcing attention from Mrs. Mack or the other students.
- 3. The S^Ds that have been associated with a given response having been punished are called stimuli discriminative for punishment (abbreviated S^{Dp}s) or negative discriminative stimuli. The S^{Dp} is a stimulus in the presence of which the individual faces an increased likelihood of receiving punishment for responding in a given fashion. Imagine Dagwood looking up from his computer game during working hours to find his boss, Mr. Dithers standing over him and watching. You can predict what follows: undoubtedly a

stream of verbal abuse of the type for which Mr. Dithers has become so notorious. Due to its association with punishment, Mr. Dithers' presence has evolved into a stimulus (an S^{Dp}) that inhibits or suppresses Dagwood's playing computer games. (For additional illustrations and an explanation of the differences of these terms and symbols, see Chapters 15 and 16.)

The degree of control exerted by antecedent stimuli is on a continuum, from tight to loose. In tight stimulus control, or stimulus discrimination, a given response only occurs in the presence of stimuli in which it has been reinforced in the past (i.e., the person "discriminates" the difference between stimuli). For example, you only open the door when the doorbell rings, not when the phone rings. Your door opening can be said to be under tight stimulus control. On the other hand, when you behave under loose stimulus control (referred to as stimulus generalization), responding occurs in the presence of stimuli sharing certain characteristics with those previously paired with reinforcement, as in your enthusiastically consuming just about any flavor or brand of ice cream. We might assert that when it comes to ice cream, you fail to discriminate the best ice-cream from the so-so. Technically, your responding generalizes across stimuli.

Here is another example, this time an amusing personal one, illustrating the difference between stimulus discrimination and stimulus generalization. In Latin cultures like those prevailing in locales like Miami, it is customary to greet people (social acquaintances as well as close friends and family) by kissing them on the cheek. As a native of Miami, one of the authors was accustomed to greeting just about any social acquaintance that way. (You could say kissing on the cheek was under loose stimulus control). When she entered graduate school in Gainesville, Florida (not a Latin culture) she attended a welcoming party. As she entered the house, she went around kissing everyone in attendance, most of whom were strangers. A cool reception greeted her! Needless to say, her kissing behavior quickly diminished in Gainesville and she only greeted people that way when back in Miami. You could say her kissing behavior came under tighter stimulus control. We will elaborate on variations in stimulus control later (in Chapter 16) when discussing in detail how stimulus control develops and functions. For the present, it is important for you to remember that stimulus control can vary appropriately or inappropriately and from tight to loose.

MOTIVATING OPERATIONS AS ANTECEDENT EVENTS

Beyond stimuli that influence behavior by signaling the likely consequences in effect, another class of antecedent event exerts control by altering the potency or value of a particular consequence. We call those events "motivating operations" or "MOs." (MOs also have been labeled establishing operations [EOs], or setting events [SEs]). Motivating operations are antecedent events that alter behavior by changing the value of a reinforcing and/or discriminative stimulus. Suppose you have not had anything to drink in the past eight hours. This deprivation makes drinking liquids more reinforcing and increases the likelihood of your seeking something to drink, say, by asking for a drink, going over to a water fountain, or using other strategies that have produced a drink in the past. Similarly, if you have just eaten a big meal and you are sated, food is less reinforcing, and behavior that has produced food in the past will decrease.

ice act If s ing

Now admit it! After all this talk about ice cream, are you tempted or did you actually go to the freezer to find some? If so, reading about or seeing this enticing picture of ice cream was a motivating operation for you! (You will learn more

about MOs in subsequent chapters.)

SUMMARY AND CONCLUSIONS

Applied behavior analysis (ABA) is designed to address essentially any behavioral challenge(s), including anything humans or animals say and do. Essentially, ABA incorporates scientifically derived principles of learning/behavior change within its practices, to effectively teach its clientele to alter their behavior in pre-determined ways. Applied behavior analysis consists of breaking observable complex behavior down into its functional parts; then reassembling those parts differently, and presumably in pre-planned ways. Given its concern with personally and socially important (classes of) behavior, though, applied behavior analysis augments those analytic methods by adding evidence-based change—strategies of change—to increase, teach, expand, reduce, or restrict the range of and maintain new levels of socially important classes of responses.

Technically, *learning* consists of altering responses as a function of environmental conditions, while *teaching* involves the intentional promotion of change, typically in groupings or *operant classes* of behaviors. In the case of ABA, the potential for more effective teaching generally increases as the body of knowledge about principles and methods for promoting effective learning continues to evolve.

Learning takes place in particular contexts composed of a multitude of stimuli, and the learned response itself may belong to any of several members of a response class, each of which are affected similarly by a given consequence. By capitalizing on principles of behavior, change agents may apply clusters of antecedents and consequences, or *behavioral procedures*, to produce the results they are pursuing, in particular places or across a number of situations.

Behavior analysts recognize two distinct categories of behavior: *respondent* (or reflexive) and *operant*. Pavlov, who pioneered research into respondent behavior, presented the world with an analysis that permitted scientists to understand, and, by rearranging pairings of stimuli, to change respondent/ physiological behavior. B. F. Skinner is credited with pioneering the analysis of operant behavior. He and his associates did this by experimentally studying particular patterns of responding implemented prior to and following given behaviors under various sets of conditions. That seminal work eventually began to evolve into systematic efforts toward addressing individuals' behavioral challenges, as in the present instance: applied behavior analysis (ABA).

A number of ABA practices have been designed, refined, and thoroughly tested. As you will learn, these include procedures designed to *increase* behavior (positive and negative reinforcement), *reduce* behavior (extinction and positive and negative punishment), *expand* (generalization), or *refine* or *narrow* (discrimination) the range of a given behavior in relation to a particular stimulus and *maintain* changed behavior over time. All of these procedures depend on carefully arranged behavioral consequences and antecedents, generally applied under particular environmental circumstances.

As time has passed, ABA practice has continued to expand widely in the challenges it addresses and to become increasingly sophisticated. In the material to follow you will learn how ABA methods are continually improving in their effectiveness, efficiency, credibility, durability, and benevolence. As you begin to master the material, surely you will find yourself contemplating ways to use your newly acquired information as a basis for bettering your own life, along with the lives of the individuals for whom you share responsibility, perhaps even those of society at large.