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SECTION TWO
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Summary

Behaviorism is the first psychological perspective to have a significant impact on our understanding of how human beings learn. In this section, I will describe the major assumptions of the behaviorist approach to learning, provide a historical overview of some of the key theorists who have contributed to the behaviorist movement, give you a brief glimpse of how behaviorism has changed in recent years, and discuss some general implications of behaviorist theories for educational practice. In the sections that follow, I will cover more specific aspects of behaviorism, including classical conditioning, operant conditioning and its applications, and the effects of aversive stimuli on learning and behavior.

ASSUMPTIONS OF BEHAVIORISM

Before the twentieth century, the two dominant perspectives in psychology were structuralism (e.g., Wilhelm Wundt’s work) and functionalism (e.g., John Dewey’s writings).
Although these two perspectives differed considerably in their underlying assumptions and topics of study, they shared a common weakness: They lacked a precise, carefully defined research methodology. The primary means of investigating learning and other psychological phenomena, especially for the structuralists, was a method called introspection: People were simply asked to "look" inside their minds and describe what they were "thinking."

Beginning with the efforts of the Russian physiologist Ivan Pavlov and the American psychologist Edward Thorndike, however, a more objective approach to the study of learning—one that focused on observable phenomena rather than on nonobservable mental events—emerged. These researchers looked primarily at behavior—something that they could easily see and objectively describe—and so the behaviorist movement was born. As will become clear later in the section, behaviorists have not always agreed on the specific processes that account for learning. Yet most of them have historically shared certain basic assumptions about learning:

- **Principles of learning apply equally to different behaviors and to different species of animals.** Behaviorists typically assume that human beings and other animals learn in similar ways—an assumption known as equipotentiality. (Behaviorists often use the term organism to refer generically to a member of any species, human and nonhuman alike.) As a result of this assumption, behaviorists often apply to human learning situations the principles that they have derived primarily from research with such animals as rats and pigeons.

- **Learning processes can be studied most objectively when the focus of study is on stimuli and responses.** Behaviorists believe that psychologists must study learning through objective scientific inquiry, in much the same way that chemists and physicists study phenomena in the physical world. By focusing on two things that they can observe and measure—more specifically, by focusing on stimuli in the environment and responses that organisms make to those stimuli—psychologists can maintain such objectivity. A behaviorist principle of learning typically describes a relationship between a stimulus (S) and a response (R); hence, behaviorism is sometimes called S-R psychology.

- **Internal cognitive processes are largely excluded from scientific study.** Many behaviorists believe that because we cannot directly observe and measure internal mental processes (e.g., thoughts, motives, and emotions), we should exclude such processes from our explanations of how learning occurs. These behaviorists describe an organism as a "black box," with stimuli impinging on the box and responses emerging from it, but with the things going on inside of it forever remaining a mystery.

- **Learning involves a behavior change.** Behaviorists define learning as a change in behavior; after all, we cannot observe any internal, mental changes that might be happening at the same time as a behavior change. In fact, some behaviorists have proposed that if no behavior change occurs, then learning cannot possibly be taking place at all.

- **Organisms are born as blank slates.** Aside from certain species-specific instincts (such as the nest-building and migratory behaviors that many birds exhibit), organisms are not born with any predispositions to behave in particular ways. Instead, organisms enter the world as "blank slates" (an idea often referred to by the Latin equivalent, tabula rasa) upon which environmental experiences gradually "write." Because each organism has a unique set of environmental experiences, so, too, will it acquire its own unique set of behaviors.

- **Learning is largely the result of environmental events.** Rather than using the term learning, behaviorists often speak of conditioning: An organism is conditioned by environmental events. The passive form of this verb connotes many behaviorists' belief that because learning is the result of one's experiences, learning happens to an organism in a way that is often beyond the organism's control.

- **The most useful theories tend to be parsimonious ones.** According to behaviorists, we should explain the learning of all behaviors, from the most simple to the most complex, by as few learning principles as possible; this assumption reflects a preference for parsimony (conciseness) in explaining learning and behavior. As you will discover in the pages
behaviors have been quite successful in using just a few simple principles to explain a great deal of human and animal behavior.

Not all behaviorists would agree with all of the assumptions I have just listed. For instance, many theorists disagree with the "black box" assumption, believing that internal factors—those within the organism (O)—are also important in understanding learning and behavior. Such neobehaviorist theorists are sometimes called S-O-R (stimulus-organism-response) theorists rather than S-R theorists.

EARLY THEORISTS IN THE BEHAVIORIST TRADITION

Numerous theorists contributed to the rise of behaviorism during the early decades of the twentieth century. The contributions of six of them—Ivan Pavlov, Edward L. Thorndike, John B. Watson, Edwin R. Guthrie, Clark L. Hull, and B. F. Skinner—are described briefly in this section. Two of these six, Pavlov and Skinner, have had such a significant impact that we will look at their theories again in more detail later.

Ivan Pavlov

The Russian physiologist Ivan Pavlov, while investigating salivation reflexes in dogs, discovered that a dog would salivate not only to food but also to other environmental events that it associated with food—for example, to the laboratory assistant who often delivered the dog’s meals. Through a systematic study of how dogs learn to salivate to different stimuli, Pavlov developed a theory of learning now commonly known as classical conditioning (e.g., Pavlov, 1927).

From Pavlov’s perspective, learning begins with a stimulus-response connection in which a particular stimulus (e.g., meat) leads to a particular response (e.g., salivation). When that stimulus is repeatedly presented in association with one or more other stimuli (e.g., with the laboratory assistant or the sound of his footsteps in the hall), those other stimuli begin to elicit a similar response. This process of classical conditioning appeared in the work of other early psychologists (e.g., Watson and Skinner) as well. We now realize that classical conditioning is a powerful force in learning, especially in the learning of emotional responses.

Edward L. Thorndike

In 1898 Edward Thorndike introduced a theory of learning that emphasized the role of experience in the strengthening and weakening of stimulus-response connections; this perspective is now known as connectionism (Thorndike, 1898, 1911, 1913). In his classic first experiment (his doctoral dissertation), Thorndike placed a cat in a “puzzle box” with a door that opened when some device (e.g., a wire loop) was appropriately manipulated. Thorndike observed the cat initiating numerous, apparently random movements in its attempts to get out of the box; eventually, by chance, the cat triggered the mechanism that opened the door and allowed escape. When returned to the box a second time, the cat again engaged in trial-and-error movements but managed to escape in less time than it had previously. With successive trials in the box, the cat, although continuing to demonstrate trial-and-error behavior, managed to escape within shorter and shorter time periods.

From his observations of cats in the puzzle box, Thorndike concluded that the learning of a behavior is affected by the consequence of that behavior (e.g., escape from a confining situation). We can sum up Thorndike’s law of effect as follows:

Responses to a situation that are followed by satisfaction are strengthened; responses that are followed by discomfort are weakened.
According to Thorndike, learning consists of trial-and-error behavior and a gradual “stamp-in” of some behaviors (those leading to satisfaction) and “stamp-out” of other behaviors (those leading to discomfort). In other words, rewarded responses increase, and punished responses diminish and disappear.

In addition to his law of effect, Thorndike proposed that practice influences S-R connections as well. His law of exercise can be paraphrased as follows:

Stimulus-response connections that are repeated are strengthened; stimulus-response connections that are not used are weakened.

In other words, practice facilitates the learning of responses. Responses that are not practiced gradually disappear.

Thorndike eventually revised his law of effect and discarded his law of exercise (Thorndike, 1935). The original law of effect implied that reward and punishment have opposite but equal effects on behavior: One strengthens and the other weakens. But Thorndike’s later research (1932a, 1932b) indicated that punishment may not be effective in weakening responses. For example, in one experiment (Thorndike, 1932a), college students completed a multiple-choice Spanish vocabulary test in which they were to choose the English translation for each of a long list of Spanish words. Every time a student chose the correct English word out of five alternatives, the experimenter said “Right!” (presumably rewarding the response); every time a student chose an incorrect alternative, the experimenter said “Wrong!” (presumably punishing the response). In responding to the same multiple-choice questions over a series of trials, the students increased the responses for which they had been rewarded but did not necessarily decrease those for which they had been punished. In his revised law of effect, Thorndike continued to maintain that rewards strengthen the behaviors they follow, but he deemphasized the role of punishment. Instead, he proposed that punishment has an indirect effect on learning: As a result of an annoying state of affairs, an organism may engage in certain other behaviors (e.g., crying or running away) that interfere with performance of the punished response.

Thorndike also conducted research (described by Trowbridge & Cason, 1932) that casts doubt on the effect of practice alone on learning. For example, in one experiment, people were blindfolded and asked to draw a series of four-inch lines. They could not see the results of their efforts, and they received no information from the experimenter about the correctness of their drawings. Without feedback, they did not improve in accuracy despite their practice, a result that led Thorndike to repudiate his law of exercise.

Although not all of Thorndike’s original ideas have stood the test of time, his belief that satisfying consequences bring about changes in behavior—in other words, that rewards promote learning—continues to be a key component of behaviorist perspectives today.

John B. Watson

Although Pavlov and Thorndike are considered to be among the earliest contributors to the behaviorist tradition, it was actually John Watson (1913) who introduced the term behaviorism and served as the most vocal advocate for the behaviorist perspective in the early part of the twentieth century.

In his major writings (Watson, 1914, 1919, 1925), Watson adamantly called for the introduction of scientific objectivity and experimentation into the study of psychological phenomena. He emphasized the need for focusing scientific inquiry on observable behaviors rather than on such nonobservable phenomena as “thinking.” Not only did Watson oppose the study of internal mental events, he denied any existence of the mind at all! Thought, he proposed, was nothing more than tiny movements of the tongue and larynx and thus was a behavior just like any other.

Greatly influenced by the work of both Pavlov and another Russian, Vladimir Bechterev (Bechterev, 1913), Watson adopted the classically conditioned S-R habit as the basic unit of learning and extended it to human learning (Watson, 1914; Watson & Rayner, 1920). Wat-
son proposed two laws that described how such habits developed. First, his law of frequency (similar to Thorndike’s law of exercise) stressed the importance of repetition:  

The more frequently a stimulus and response occur in association with each other, the stronger that S-R habit will become.

Second, Watson’s law of recency stressed the importance of timing:

The response that has most recently occurred after a particular stimulus is the response most likely to be associated with that stimulus.

In other words, the last response that an organism has made to a stimulus is the one most likely to occur the next time the stimulus is presented. Through his law of recency, Watson rejected Thorndike’s law of effect. According to Watson, reward has only an indirect effect on learning in that the most recent response is the one rewarded. For example, when a cat is in a puzzle box, the last response is the one that leads to escape and so is most likely to be connected to that stimulus situation.

Watson believed that past experience accounts for virtually all behavior. His extreme environmentalism, which denied that hereditary factors had any effect on behavior whatsoever, was reflected in the following infamous quote:

Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I’ll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief, and yes, even beggar-man and thief regardless of his talents, penchants, tendencies, abilities, vocations and race of his ancestors. (Watson, 1925, p. 82)

Watson’s influence continued to be felt long after he retired from academia in 1920. His strong advocacy of psychology as an objective and precise science and his insistence that environment plays a key role in human behavior led to a behaviorist tradition that dominated psychological research and theory in the western hemisphere until the 1960s.

Edwin R. Guthrie

Edwin Guthrie’s contiguity theory (Guthrie, 1935, 1942) was similar to John Watson’s perspective in that it emphasized S-R connections and rejected the role of reward in developing these connections. Guthrie’s basic principle of learning was as follows:

A stimulus that is followed by a particular response will, upon its recurrence, tend to be followed by the same response again. This S-R connection gains its full strength on one trial.

In other words, if an organism responds to a particular stimulus in a particular way on one occasion, the organism will make the same response the next time it encounters the same stimulus; in this manner, a habit is formed. Guthrie contended that the critical factor in learning is the contiguity—the more or less simultaneous occurrence—of a stimulus and a response.

Guthrie also shared Watson’s belief that recency is critical in learning: An organism will respond to a stimulus in the way that it has most recently responded to that stimulus. A reward facilitates learning only to the extent that it removes the organism from the stimulus, thus preventing subsequent responses from being associated with that stimulus.

Guthrie’s notion of one-trial learning—that an S-R connection is fully formed on one pairing—was quite different from Thorndike’s idea that responses are gradually “stamped in.” Guthrie explained the gradual learning of complex behavior by proposing that complex behavior is actually composed of many tiny S-R connections; with each practice trial, more and more appropriate S-R connections are formed, thus leading to the gradual changes observed in overall behavior.

The parsimony of Guthrie’s theory—his proposal that the contiguity of stimuli and responses is the basis of all learning—is definitely appealing. Guthrie conducted little research
to support his views, however, and later research has cast doubt on the notion that learning is as simple as Guthrie described it (Bower & Hilgard, 1981). Nevertheless, three techniques for breaking S-R habits that Guthrie derived from his theory continue to be used in educational and therapeutic practice. We will look at these techniques later in this section.

Clark L. Hull

It was primarily the work of Clark Hull (1943, 1951, 1952) that introduced ‘organismic’ characteristics—characteristics unique to different organisms—into behaviorist learning theory. Like many of his predecessors, Hull maintained that learned S-R habits form the basis of behavior. Furthermore, he agreed with Thorndike about the importance of rewards in the learning process. However, he believed that the presence of a particular stimulus and one’s past experiences with that stimulus are not the only determinants of whether a particular response will occur or how strongly it will be made. Hull proposed that a number of other factors (intervening variables) unique to each organism and each occasion must be considered in order to predict the likelihood and strength of a response’s occurrence. Hull’s theory was therefore the first major theory of the S-O-R genre.

According to Hull, one intervening variable influencing the occurrence of a response is habit strength, the degree to which a particular stimulus and a particular response are associated. The more often a response has previously been rewarded in the presence of the stimulus, the greater is the habit strength and the more likely the response is to occur.

A second intervening variable critical for a response to occur is the organism’s drive, an internal state of arousal that motivates its behavior. Hull suggested that some drives (e.g., hunger and thirst) are directly related to an organism’s survival. Other drives (called acquired drives) serve no apparent biological purpose; they develop over time when initially ‘unexciting’ stimuli are associated with such drive-reducing stimuli as food or drink. To illustrate, one might become ‘driven’ by a need for approval if approval has previously been associated with a candy bar. From Hull’s perspective, rewards increase the strength of an S-R habit by reducing the organism’s drive (e.g., food reduces hunger).

Hull proposed that intervening variables such as habit strength, drive, stimulus intensity (with an intense stimulus bringing about a stronger response than a weak stimulus), and incentive (based on the amount and immediacy of reward) all work together to increase the likelihood and relative strength of a particular response. At the same time, inhibitory factors (e.g., fatigue) decrease the likelihood and strength of the response.

According to Hull, an organism might learn several different responses to the same stimulus, each with a different degree of habit strength. The combination of the various S-R habits for a given stimulus, with their respective habit strengths, is known as a habit-family hierarchy. When a stimulus is presented, an organism will, if possible, make the response for which the habit strength is the strongest. If the organism is somehow prevented from making that response, however, it will try to make the second response, or, if again foiled, the third response, and so on down the hierarchy.

As an illustration of this concept of habit-family hierarchy, consider George, who faces a homework assignment involving the multiplication of fractions. George may first try to complete the assignment using the technique his teacher taught him for multiplying fractions. If he finds that he cannot remember the technique, he may instead ask his friend Angela if he may copy her answers. If Angela refuses his request, he may resort to a third response in his hierarchy: telling his teacher that the family dog ate his homework.

Hull developed a series of mathematical formulas through which the occurrence and strength of responses might be predicted once the various intervening variables were measured and their values entered. The precision of Hull’s formulas permitted a careful testing of his theory through research, and many specifics of the theory were found to be incorrect (Bower & Hilgard, 1981; Klein, 1987). For example, learning apparently can take place in the absence of drive. In addition, Hull proposed that a reward is a stimulus that reduces drive, yet some rewards actually appear to increase drive (Olds & Milner, 1954).
Hull’s theory was a predominant force in behaviorism throughout the 1940s and 1950s. Although many details of the theory did not hold up under empirical scrutiny, Hull’s emphasis on intervening variables made such notions as motivation and incentive prominent concepts in learning research. And his many productive students—among them Kenneth Spence, Neil Miller, John Dollard, and O. H. Mowrer—have continued to advance and modify Hullian ideas.

Burrhus Frederic Skinner

B. F. Skinner (1938, 1953, 1958, 1966b, 1971, 1989; Skinner & Epstein, 1982) is unquestionably the best-known psychologist in the behaviorist tradition. Originally a fiction writer, Skinner was lured into psychology by the ideas of Pavlov and Watson (Skinner, 1967). His principles of operant conditioning, first proposed in 1938, underwent little change in the five decades before his death in 1990. Operant conditioning principles have served as the basis for thousands of research studies and have been applied extensively in both educational and therapeutic settings. I will present an overview of Skinner’s ideas here and then describe operant conditioning again in more detail later.

Skinner, like Thorndike and Hull, proposed that we learn behaviors that are followed by certain consequences. Unlike his predecessors, however, Skinner spoke only about the strengthening of responses, not the strengthening of S-R habits. Skinner’s use of the term reinforcer instead of reward reflects his concern that psychologists remain objective in their examination of behavior and not try to guess what people or other organisms find pleasing (rewarding) or why the reinforcer has a particular effect on behavior.

To study the effects of reinforcers using precise measurement of responses in a carefully controlled environment, Skinner developed a piece of equipment, now known as the Skinner box, that has gained widespread popularity in animal learning research. The Skinner box used in studying rat behavior includes a metal bar that, when pushed down, causes a food tray to swing into reach long enough for the rat to grab a food pellet. In the pigeon version of the box, instead of a metal bar, a lighted plastic disk (a “key”) is located on one wall; when the pigeon pecks the key, the food tray swings into reach for a short time. By observing rats and pigeons in their respective Skinner boxes under varying conditions of reinforcement, Skinner developed a set of principles that focuses on a description of learning rather than an explanation of it; hence, some psychologists view Skinner’s perspective more as a “nontuition” than a theory of learning.

Skinner’s most fundamental principle of operant conditioning, his law of conditioning, can be paraphrased as follows:

A response followed by a reinforcing stimulus is strengthened and therefore more likely to occur again.

A corollary to this principle, Skinner’s law of extinction, is as follows:

A response that is not followed by a reinforcing stimulus is weakened and therefore less likely to occur again.

Unlike Watson, Skinner acknowledged the existence of thought, particularly as it is reflected in verbal behavior (e.g., Skinner, 1963, 1989). Nevertheless, he contended that the causes of mental events (including thoughts) lie in the environment and so argued that a stimulus-response approach to the study of learning, which emphasizes the impact of environment on behavior, is still quite appropriate.

Although Skinner focused his research almost exclusively on how animals acquire such simple responses as pressing a bar or pecking a key, he used his principles of operant conditioning to explain a variety of complex human behaviors (e.g., Skinner, 1948b, 1957, 1971) and to recommend instructional strategies that teachers might use in the classroom (e.g., Skinner, 1954, 1958, 1968, 1973).
CONTEMPORARY BEHAVIORISM

Although much of the work in human learning has shifted toward a cognitive perspective in recent years, the behaviorist movement is still very much alive and well. Pavlov’s classical conditioning and Skinner’s operant conditioning remain as major theoretical perspectives that are continually refined by ongoing research (still conducted primarily with animals) and applied successfully to educational and clinical settings.

Several trends characterize the gradual evolution of early behaviorist theories into contemporary behaviorism. One trend is an increased focus on motivation as a major factor affecting learning and performance (e.g., Herrnstein, 1977). A second change subsequent to early theories is increased attention to the role of aversive consequences (punishment) in learning. Early theorists such as Thorndike, Guthrie, and Skinner maintained that punishment had little or no effect on behavior; however, a growing body of research indicates that aversive consequences do influence behavior (e.g., Rachlin, 1991). A third trend is an increasing recognition that learning and performance must be considered as separate, albeit related, entities. A number of psychologists (e.g., Brown & Herrnstein, 1975; Estes, 1969a; Herrnstein, 1977; Schwartz & Reisberg, 1991) have proposed that many behaviorist laws are more appropriately applied to an understanding of what influences the performance of learned behaviors rather than what influences learning itself. But perhaps the most dramatic (and certainly the most surprising) change in recent years is the growing belief among traditionally behaviorist psychologists that they can more effectively understand both human and animal behavior when they consider cognitive factors as well as environmental events (Church, 1993; Hulse, 1993; Rachlin, 1991; Rescorla, 1988; Schwartz & Reisberg, 1991; Wasserman, 1993).

GENERAL EDUCATIONAL IMPLICATIONS OF BEHAVIORISM

From what we have learned about behaviorist ideas so far, we can derive several implications for teaching practice: an emphasis on behavior, drill and practice, methods for breaking habits, and rewards (reinforcement) for desirable behavior.

Emphasis on Behavior

As we have already noted, behaviorists define learning as a change in behavior due to experience. This emphasis on behavior has at least two implications for education. First, students should be active respondents throughout the learning process rather than just passive recipients of whatever information is being taught. From a behaviorist perspective, people are more likely to learn when they actually have a chance to behave—for example, when they can talk, write, experiment, or demonstrate (e.g., see Drevno et al., 1994).

A second implication of the behaviorist perspective relates to the assessment of student learning. Regardless of how effective teachers think a certain lecture or a particular set of curriculum materials might be, they should never assume that students are learning anything unless they actually observe students’ behaviors changing as a result of instruction. Only behavior changes—such as higher test scores, improved athletic performance, more appropriate social interaction skills, or better study habits—can ultimately confirm that learning has taken place.

Drill and Practice

Many behaviorists have stressed the principle that repetition of stimulus-response habits strengthens those habits. If people need to learn responses to particular stimuli thoroughly, then practice is essential. For example, students learn basic addition and subtraction facts better and recall them more quickly if they repeat those facts numerous times (e.g., through
the use of flash cards). In a similar way, many reading teachers believe that the best way for students to improve their reading level is simply to read, read, read.

**Breaking Habits**

Guthrie’s notion of recency—the idea that an organism will respond to a stimulus in the same way that it responded on the most recent previous encounter with that stimulus—implies that habits, once formed, are difficult to break. The trick in breaking a habit, from the perspective of the recency principle, is to lead an individual, in one way or another, to make a new response to the same old stimulus.

As an example, Guthrie (1935) described a girl who, upon entering the house after school each day, had the nasty habit of throwing her hat and coat on the floor rather than hanging up her garments. Despite repeated entreaties by the child’s mother to change the sloppy behavior, the habit continued. One day, however, rather than admonishing the girl, the mother insisted that her daughter put her hat and coat back on, go outside, reenter the house, and hang up her clothes. The hanging-up response, being the one most recently exhibited, now became a new habit for the girl, and the throwing-on-the-floor response disappeared.

Guthrie proposed three ingenious techniques specifically designed to break habits: the exhaustion method, the threshold method, and the incompatible stimulus method.

**Exhaustion Method**

One way to break a stimulus-response habit is to continue to present the stimulus until the individual is too tired to respond in the habitual way. At that point, a new response will occur and a new S-R habit will form. For example, when breaking a bucking bronco, the persistent rider (the stimulus) stays on the horse’s back until the horse is too exhausted to continue bucking; a new response (behavior reflecting acceptance of the rider, such as standing still) then becomes associated with the “rider” stimulus. Similarly, a teacher might eliminate a child’s spitball-throwing behavior by having that child stay after school to make and throw spitballs until the child is too tired to continue.

**Threshold Method**

Another way of breaking a habit is to begin by presenting the stimulus so faintly that the individual does not respond to it in the habitual manner. The intensity of the stimulus is then increased so gradually that the individual continues not to respond to it. For example, when a student has test anxiety (in other words, when a test stimulus leads to an anxiety response), a teacher might eliminate that child’s anxiety by first presenting tasks that are enjoyable to the child and only remotely resemble a test. Over time, the teacher can present a series of tasks that increasingly (but gradually) begin to take on testlike qualities.

**Incompatible Stimulus Method**

A third method for breaking a S-R connection is to present the stimulus when the habitual response cannot occur and when an opposite, or incompatible, response will occur. For example, Guthrie recommended tying a dead chicken around a dog’s neck to teach the dog not to catch and eat chickens. The dog will struggle to get rid of the annoying chicken, thereby making a response that is incompatible with catching and eating the chicken. Similarly, imagine a classroom of highly achievement-motivated students who are overly competitive with one another. To reduce the competition among students, the teacher might divide the class into small groups and assign each group an academic task that requires cooperation rather than competition (e.g., developing an argument for one side of an issue in a class debate). Assigning grades on the basis of group performance rather than individual performance should increase the likelihood that students will cooperate. Hence, cooperative behavior will replace competitive behavior in that classroom environment.
Rewards (Reinforcement) for Desirable Behavior

Many behaviorists, Thorndike and Skinner among them, have emphasized the importance of rewards or reinforcement for learning. Students are most likely to learn and exhibit behaviors that lead to desired results.

SUMMARY

Behaviorism encompasses a group of theories that share several common assumptions, including the generalizability of learning principles across species, the importance of focusing on external, observable events (i.e., on stimuli and responses), and the "blank slate" nature of organisms. Early learning theorists—Pavlov, Thorndike, Watson, Guthrie, Hull, and Skinner—all viewed learning somewhat differently, but each made a unique contribution to our understanding of how human beings learn. For example, Pavlov outlined the basic components of classical conditioning; Watson and Guthrie described the importance of contiguity between a stimulus and a response; and Thorndike, Skinner, and Hull documented how the consequences that follow responses bring about behavior change. All of these theorists made us cognizant of the fact that past and present events have a strong influence on the behaviors we exhibit.

Contemporary behaviorists do not always adhere to traditional behaviorist assumptions; for example, they may make a distinction between learning and performance or they may believe that relationships between stimuli and responses can be better understood when cognitive factors are also taken into account. Educational implications of behaviorism include an emphasis on observable behavior, the use of drill and practice for teaching basic skills, several methods for breaking habits, and attention to the consequences of student behaviors.
Classical Conditioning

Pavlov's Experiment
The Classical Conditioning Model
Classical Conditioning in Human Learning
Basic Concepts in Classical Conditioning
   Extinction
   Spontaneous Recovery
   Stimulus Generalization
   Stimulus Discrimination
   Higher-Order Conditioning
   Sensory Preconditioning
Contemporary Perspectives on Classical Conditioning
Changing Inappropriate Conditioned Responses
   Extinguishing Undesirable Responses
   Counterconditioning More Desirable Responses
Educational Implications of Classical Conditioning
Summary

I have a ‘thing’ about bees. Whenever a bee flies near me, I scream, wave my arms frantically, and run around like a wild woman. Yes, yes, I know, I will be better off if I remain perfectly still, but somehow I just can’t control myself. My overreaction to bees is probably due to the several painful bee stings I received as a small child.

One way to explain how people develop involuntary responses to particular stimuli, such as my fearful reaction to bees, is a theory of learning known as classical conditioning. This theory originated with the work of Ivan Pavlov, so we will begin this section by reviewing his classic research with dogs. We will then consider how we can apply Pavlov’s learning paradigm to help us understand human learning and behavior. We will survey several phenomena associated with classical conditioning: extinction, spontaneous recovery, stimulus generalization and discrimination, higher-order conditioning, and sensory preconditioning. We will also see how the behaviorist perspective on classical conditioning has changed in recent years. Finally, we will look at ways of eliminating undesirable responses using the classical conditioning model and at some specific implications of the model for educational practice.

Taken from Human Learning, Third Edition by Ormrod.
PAVLov's EXPERIMENT

Pavlov, a Russian physiologist whose work on digestion earned him a Nobel Prize in 1904, was conducting a series of experiments related to salivation in dogs. To study a dog’s salivation responses, he would make a surgical incision in the dog’s mouth, thus enabling him to collect and measure its saliva. After strapping the dog into an immobile position, he would give it some powdered meat and observe its resulting salivation. Pavlov noticed that the dog soon began to salivate before it saw or smelled the meat—in fact, it salivated as soon as the laboratory assistant entered the room with the meat. Apparently, the dog had learned that the lab assistant meant food was on the way and responded accordingly. Pavlov devoted a good part of his later years to a systematic study of this learning process upon which he had so inadvertently stumbled, and he eventually summarized his research in his book *Conditioned Reflexes* (Pavlov, 1927).

Pavlov’s original studies of classical conditioning went something like this:

1. He first observed whether the dog salivated in response to a particular stimulus—perhaps to a flash of light, the sound of a tuning fork, or the ringing of a bell. For simplicity’s sake, we will continue with our discussion using a bell as the stimulus in question. As you might imagine, the dog did not find a bell especially appetizing and so did not salivate.
2. Pavlov then rang the bell again and this time followed it immediately with the presentation of some powdered meat. The dog, of course, salivated. Pavlov rang the bell several more times, always presenting meat immediately afterward. The dog salivated on each occasion.
3. Pavlov then rang the bell again without presenting any meat. Nevertheless, the dog salivated. The bell, to which the dog had previously been unresponsive (in step one), now led to a salivation response. There had been a change in behavior due to experience; from the behaviorist perspective, then, learning had taken place.

Let’s analyze the three steps in Pavlov’s experiment in much the same way as he did:

1. A neutral stimulus (NS) is a stimulus to which the organism does not respond. In the case of Pavlov’s dog, the bell was originally a neutral stimulus that did not elicit a salivation response.
2. The neutral stimulus is presented just before another stimulus, one that does lead to a response. This second stimulus is called an unconditioned stimulus (UCS), and the response to it is called an unconditioned response (UCR), because the organism responds to the stimulus unconditionally, without having had to learn to do so. (Pavlov’s original term was actually unconditioned, but the mistranslation to unconditioned remains in most classical conditioning literature.) For Pavlov’s dog, meat powder was an unconditioned stimulus to which it responded with the unconditioned response of salivation.
3. After being paired with an unconditioned stimulus, the previously neutral stimulus now elicits a response, so it is no longer neutral. The NS has become a conditioned stimulus (CS) to which the organism has learned a conditioned response (CR). In Pavlov’s experiment, the bell, after being paired with the meat (the unconditioned stimulus) became a conditioned stimulus that led to the conditioned response of salivation. The diagram in Figure 2-1 shows graphically what happened from a classical conditioning perspective.

Pavlov’s studies of classical conditioning continued long after this initial experiment, and many of his findings have been replicated with other responses and in other species, including humans. Let’s take a closer look at the process of classical conditioning and at some examples of how it occurs in human learning.
THE CLASSICAL CONDITIONING MODEL

Classical conditioning has been demonstrated in many species—not only in dogs and laboratory rats but also in newborn human infants (Lipsitt & Kaye, 1964; Reese & Lipsitt, 1970), human fetuses still in the womb (Macfarlane, 1978), and even organisms as simple as flatworms (Thompson & McConnell, 1955). The applicability of classical conditioning clearly extends widely across the animal kingdom.

As Pavlov's experiments illustrated, classical conditioning occurs when two stimuli are presented at approximately the same time. One of these stimuli is an unconditioned stimulus: It has previously been shown to elicit an unconditioned response. The second stimulus, through its association with the unconditioned stimulus, begins to elicit a response as well. It becomes a conditioned stimulus that brings about a conditioned response. In many cases, conditioning occurs relatively quickly; it is not unusual for an organism to show a conditioned response after the two stimuli have been presented together only five or six times, and sometimes after only one pairing (Rescorla, 1988).

Classical conditioning is most likely to occur when the conditioned stimulus is presented just before (perhaps by half of a second) the unconditioned stimulus. For this reason, some psychologists describe classical conditioning as a form of signal learning. By being presented first, the conditioned stimulus serves as a signal that the unconditioned stimulus is coming, much as Pavlov's dog might have learned that the sound of a bell indicated that yummy meat powder was on its way.

Classical conditioning usually involves the learning of involuntary responses—responses over which the learner has no control. When we say that a stimulus elicits a response, we mean that the stimulus brings about a response automatically, without the individual having much control over the occurrence of that response. In most cases, the conditioned response is similar to the unconditioned response (but see Hergenhahn & Olson, 1997; Hollis, 1997; or Rachlin, 1991, for exceptions), with the two responses differing primarily in terms of which stimulus elicits the response and sometimes in terms of the strength of the response.

CLASSICAL CONDITIONING IN HUMAN LEARNING

We can use classical conditioning theory to help us understand how people learn a variety of involuntary responses. For example, many people develop aversions to particular foods as a result of associating those foods with an upset stomach (Garb & Stunkard, 1974; Logue, 1979). To illustrate, after associating the taste of creamy cucumber salad dressing (CS) with the nausea I experienced during pregnancy (UCS), I developed an aversion (CR) to cucumber dressing that lasted for several years.

For many people, darkness is a conditioned stimulus for going to sleep, perhaps in part because it has frequently been associated with fatigue. I once became uncomfortably aware

---

**Figure 2-1**

A classical conditioning analysis of Pavlov’s dog.

<table>
<thead>
<tr>
<th>Step 1:</th>
<th>NS (bell)</th>
<th>(no response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2:</td>
<td>NS (bell)</td>
<td>UCS (meat)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UCR (salivate)</td>
</tr>
<tr>
<td>Step 3:</td>
<td>CS (bell)</td>
<td>CR (salivate)</td>
</tr>
</tbody>
</table>
of how conditioned I was when I attended my daughter Tina’s “astronomy night” at school. We parents were ushered into a classroom and asked to sit down. Then the lights were turned off, and we watched a half-hour filmstrip describing a NASA space museum. Although I am usually quite alert during the early evening hours, I found myself growing increasingly drowsy, and probably only my upright position in an uncomfortable metal chair kept me from losing consciousness altogether. In that situation, the darkness elicited a go-to-sleep response, and there were no stimuli (certainly not the filmstrip) to elicit a stay-awake response.

Classical conditioning is also a useful model for explaining some of the fears and phobias that people develop. For example, my bee phobia can probably be explained by the fact that bees (CS) were previously associated with a painful sting (UCS), such that I became increasingly fearful (CR) of the nasty insects. In a similar way, people who are bitten by a particular breed of dog sometimes become afraid of that breed, or even of all dogs.

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BASIC CONCEPTS IN CLASSICAL CONDITIONING

Pavlov described a number of phenomena characteristic of classical conditioning. Here we examine several of them: extinction, spontaneous recovery, stimulus generalization, stimulus discrimination, higher-order conditioning, and sensory preconditioning.

Extinction

Let's return for a moment to Pavlov's dog. Remember that the dog learned to salivate at the sound of a bell alone after that bell had rung in conjunction with meat powder on several occasions. But what would happen if the bell continued to ring over and over without the meat powder's ever again being presented along with it? Pavlov discovered that repeated presentations of the conditioned stimulus alone led to successively weaker and weaker conditioned responses. Eventually, the dog no longer salivated at the sound of the bell; in other words, the conditioned response disappeared.

The disappearance of a conditioned response when a conditioned stimulus is repeatedly presented without the unconditioned stimulus is a phenomenon Pavlov called extinction. For example, The Look from my mother no longer has the effect it used to. Whatever punishment was once associated with it has long since disappeared (and besides, now I'm bigger than she is).

Sometimes conditioned responses will extinguish, and sometimes they will not. The unpredictability of extinction is a source of frustration to anyone working with people who have acquired inappropriate, yet involuntary, conditioned responses. Later in the section, we identify some reasons why extinction does not always occur.

Spontaneous Recovery

Even though Pavlov quickly extinguished his dog's conditioned salivation response by repeatedly presenting the bell in the absence of meat powder, when he entered his laboratory the following day he discovered that the bell once again elicited salivation in the dog, almost as if extinction had never taken place. This reappearance of the salivation response after it had previously been extinguished is something Pavlov called spontaneous recovery.

In more general terms, spontaneous recovery is a recurrence of a conditioned response when a period of extinction is followed by a rest period. For example, if I am near lots of bees for a period of time, I eventually settle down and regain my composure. However, my first response on a later encounter with a bee is to fly off the handle once again.

Pavlov found that when a conditioned response appears in spontaneous recovery, it is typically weaker than the original conditioned response and extinguishes more quickly. In situations in which a CR spontaneously recovers several times, each time after a period of rest has elapsed, the response appears in a weaker form than it had previously and disappears more rapidly.

Stimulus Generalization

You may recall that Little Albert, after being conditioned to fear a white rat, also became afraid of a rabbit, a dog, a fur coat, cotton wool, and a fuzzy-bearded Santa Claus mask. When individuals respond to other stimuli in the same way that they respond to conditioned stimuli, stimulus generalization is occurring. The more similar a stimulus is to the conditioned stimulus, the greater the probability of stimulus generalization. Albert exhibited fear of all objects that were white and fuzzy like the rat, but he was not afraid of his nonwhite, nonfuzzy toy blocks. In a similar way, a child who fears an abusive father may generalize that fear to other men but not to women.

Generalization of conditioned responses to new stimuli is a common phenomenon (Bouton, 1994). In some cases, generalization of conditioned fear responses may actually increase...
over time; that is, as time goes on, an individual may become fearful of an increasing number of objects (McAllister & McAllister, 1965). Thus, conditioned responses that do not quickly extinguish may actually become more frequent as the years go by because they are being elicited by an increasingly greater number of stimuli.

**Stimulus Discrimination**

Pavlov observed that when he conditioned a dog to salivate in response to a high-pitched tone, the dog would generalize that conditioned response to a low-pitched tone. To teach the dog the difference between the two tones, Pavlov repeatedly presented the high tone in conjunction with meat powder and presented the low tone without meat. After several such presentations of the two tones, the dog eventually learned to salivate only to the high tone. In Pavlov’s terminology, *differentiation* between the two tones had taken place. Psychologists today more frequently use the term *stimulus discrimination* for this phenomenon.

Stimulus discrimination occurs when one stimulus (the CS1) is presented in conjunction with an unconditioned stimulus, and another stimulus (the CS2) is presented without that UCS. The individual learns a conditioned response to the CS1 but does not generalize the response to the CS2. For example, if a child who is abused by her father simultaneously has positive interactions with other adult men, she is not as likely to generalize her fear of her father to those other individuals.

**Higher-Order Conditioning**

Pavlov also described a phenomenon known as *second-order conditioning*, or more generally *higher-order conditioning*. When a dog had been conditioned to salivate to the sound of a bell, and the bell was later presented in conjunction with a neutral stimulus such as a flash of light, that neutral stimulus would also begin to elicit a salivation response, even though it had never been directly associated with meat. In other words, the light flash became a conditioned stimulus through its pairing not with the unconditioned stimulus, but with another conditioned stimulus.

Higher-order conditioning works like this: First, a neutral stimulus (NS1) becomes a conditioned stimulus (CS1) by being paired with an unconditioned stimulus (UCS) and therefore elicits a conditioned response (CR). Next, a second neutral stimulus (NS2) is paired with CS1 and then independently elicits a similar conditioned response; that second stimulus has also become a conditioned stimulus (CS2).

A diagram of higher-order conditioning appears in Figure 2–2. Steps 1 and 2 depict the original conditioning; steps 3 and 4 depict higher-order conditioning, in which a second neutral stimulus becomes a CS2 by virtue of its being paired with the CS1.

**Figure 2–2**

An example of higher-order conditioning.

- **Step 1**: NS1 (bell) → UCS (meat) → CR (salivate)
- **Step 2**: CS1 (bell) → CR (salivate)
- **Step 3**: NS2 (light) → CS1 (bell) → CR (salivate)
- **Step 4**: CS2 (light) → CR (salivate)
Higher-order conditioning is a possible explanation for some of the fears that students exhibit in the classroom (e.g., Klein, 1987). Let’s say, first of all, that failure has previously been associated with painful physical punishment. Then another situation—perhaps a test, an oral presentation in front of classmates, or even school itself—becomes associated with failure. The painful punishment is the UCS. Failure, originally a neutral stimulus (NS₁), becomes a CS₂ after its association with the UCS. Some other aspect of school (e.g., a test), while first a neutral stimulus (NS₂), becomes an additional conditioned stimulus (CS₂) through its association with CS₁. In this way, a student may develop test anxiety, fear of public speaking, or even school phobia—fear of school itself.

Sensory Preconditioning

Higher-order conditioning is one way an individual can develop a conditioned response to a stimulus that has never been directly paired with an unconditioned stimulus. Sensory preconditioning is very similar to higher-order conditioning except that the steps occur in a different order. Let me first illustrate the process by once again conditioning Pavlov’s poor, overworked dog. Suppose that we first present the sound of a bell and a flash of light simultaneously. Then we pair the bell with meat powder. Not only does the dog salivate in response to the sound of a bell, we discover that it also salivates in response to the flash of light.

In more general terms, sensory preconditioning occurs like this: First, two neutral stimuli (NS₁ and NS₂) are presented simultaneously. Then one of these neutral stimuli (NS₁) is associated with an unconditioned stimulus (UCS), thus becoming a conditioned stimulus (CS₁) and eliciting a conditioned response (CR). In cases of sensory preconditioning, the second neutral stimulus (NS₂) also elicits the conditioned response (i.e., NS₂ has become CS₂) by virtue of its prior association with CS₁.

Klein (1987) has suggested that sensory preconditioning may be an alternative explanation for some cases of test anxiety. School (NS₁) is first associated with tests (NS₂). If school is later associated with some traumatic event (UCS), then not only will school become a conditioned stimulus (CS₁) eliciting anxiety (CR), but tests may become a conditioned stimulus (CS₂) as well. A diagram of how test anxiety might develop through sensory preconditioning is presented in Figure 2–3.

Figure 2–3
An example of sensory preconditioning.

Step 1:

\[ \text{NS}_1 \ (\text{school}) \]
\[ \text{NS}_2 \ (\text{tests}) \]

\[ \text{CS}_1 \ (\text{school}) \]
\[ \text{CR} \ (\text{anxiety}) \]

Step 2:

\[ \text{Step 2: NS}_1 \ (\text{school}) \]
\[ \text{UCS} \ (\text{traumatic event}) \]

\[ \text{UCR} \ (\text{anxiety}) \]

Step 3:

\[ \text{CS}_1 \ (\text{school}) \]
\[ \text{CR} \ (\text{anxiety}) \]

Step 4:

\[ \text{CS}_2 \ (\text{tests}) \]
\[ \text{CR} \ (\text{anxiety}) \]
CONTEMPORARY PERSPECTIVES ON CLASSICAL CONDITIONING

Numerous psychologists have followed up on Pavlov’s original studies of the classical conditioning phenomenon. Their research has led to several recent developments in our understanding of when and how classical conditioning occurs:

• Contingency between the conditioned and unconditioned stimuli is probably more important than their contiguity. Pavlov proposed that classical conditioning occurs when the unconditioned stimulus and the would-be conditioned stimulus are presented at approximately the same time; in other words, there must be contiguity between the two stimuli. In fact, as we noted earlier, classical conditioning is most likely to occur when the conditioned stimulus is presented just before the unconditioned stimulus. Conditioning is less likely to occur when the CS and UCS are presented at exactly the same time, and it rarely occurs when the CS is presented after the UCS (e.g., Miller & Barnet, 1993). Furthermore, people sometimes develop an aversion to certain foods (remember my aversion to creamy cucumber dressing) when the delay between the conditioned stimulus (food) and the unconditioned stimulus (nausea) is as much as 24 hours (Logue, 1979). As you can see, contiguity between the two stimuli is an overly simplistic explanation of how a conditioned response is acquired.

More recent theorists (e.g., Granger & Schlimmer, 1986; Rachlin, 1991; Rescorla, 1987; 1988) have proposed that contingency is the essential condition. The potential conditioned stimulus must occur only when the unconditioned stimulus is about to follow—in other words, when the CS serves as a signal that the UCS is coming (remember my reference to classical conditioning as “signal learning” earlier in the section). When two stimuli that are usually presented separately occur together a few times by coincidence, classical conditioning is unlikely to occur.

• Characteristics of the would-be conditioned stimulus affect the degree to which conditioning occurs. The more noticeable (salient) a neutral stimulus—in other words, the extent to which it is bright, loud, or otherwise intense—the more likely it is to become a conditioned stimulus when presented in conjunction with an unconditioned stimulus (Rachlin, 1991; Schwartz & Reisberg, 1991). Furthermore, some stimuli are especially likely to become associated with certain unconditioned stimuli; for example, food is more likely to become a conditioned stimulus associated with nausea (a UCS) than, say, a light or the sound of a tuning fork. In other words, associations between certain stimuli are more likely to be made than are associations between others—a phenomenon known as associative bias (Garcia & Koelling, 1966; Hollis, 1997; Schwartz & Reisberg, 1991).

• Classical conditioning involves cognition as well as responding. Some theorists now believe that classical conditioning involves the formation of associations not between two stimuli but between internal mental representations of those stimuli (Bouton, 1994; Furedy & Riley, 1987; Miller & Barnet, 1993; Rachlin, 1991; Rescorla, 1988; Schwartz & Reisberg, 1991; Wagner, 1976, 1978, 1979, 1981). Furthermore, the conditioned stimulus may enable an organism to predict (in a decidedly mental fashion) that the unconditioned stimulus is coming (Hollos, 1997; Martin & Levey, 1987; Rescorla, 1967, 1980; Rescorla & Wagner, 1972; Schwartz & Reisberg, 1991; Wagner & Rescorla, 1972). As you can see, then, some behaviorists are now beginning to talk about the thinking processes that they so deliberately steered clear of in earlier years.

CHANGING INAPPROPRIATE CONDITIONED RESPONSES

Conditioned responses are often difficult to eliminate because they are involuntary. People have little or no control over them. Yet some classically conditioned responses (e.g., some irrational fears) may be detrimental to an individual’s functioning. How can we get rid of counterproductive conditioned responses? Extinction and counterconditioning are two possible methods.
Extinguishing Undesirable Responses

One obvious way to eliminate a conditioned response is through the process of extinction. If the conditioned stimulus is presented in the absence of the unconditioned stimulus frequently enough, the conditioned response should disappear—which is often exactly what happens. Unfortunately, however, extinction is notoriously unpredictable as a means of eliminating conditioned responses: it simply doesn’t always work. There are at least three reasons why:

1. The speed at which extinction occurs is unpredictable. If, during the conditioning process, the conditioned stimulus was sometimes presented in conjunction with the unconditioned stimulus but sometimes alone (i.e., the stimulus pairings were inconsistent), extinction is likely to be especially slow (Humphreys, 1939).

2. People tend to avoid a stimulus they have learned to fear, thus reducing the chances that they might eventually encounter the conditioned stimulus in the absence of the unconditioned stimulus. For example, a student who has learned to fear mathematics after a history of failing the subject typically avoids math as much as possible, thus minimizing any chance of experiencing math without failure.

3. Even when a response has been extinguished, it may reappear through spontaneous recovery. We can never be totally sure when a response will spontaneously recover and when it will not. Spontaneous recovery is especially likely if extinction has occurred in only one context; the conditioned response is apt to reappear in contexts in which extinction has not taken place (Bouton, 1994).

Counterconditioning More Desirable Responses

In an alternative procedure to extinction, called counterconditioning, one conditioned response is replaced with a new, more beneficial conditioned response. Counterconditioning tends to be more effective than extinction in eliminating undesirable conditioned responses; it also decreases the chances that those responses will recur through spontaneous recovery.

Mary Cover Jones’s (1924) classic work with ‘Little Peter’ provides an excellent example of counterconditioning. Peter was a two-year-old boy who had somehow acquired a fear of rabbits. To rid Peter of his fear, Jones placed him in a high chair and gave him some candy. As he ate, she brought the rabbit into the far side of the same room. Under different circumstances the rabbit might have elicited anxiety; however, the pleasure Peter felt as he ate the candy was a stronger response and essentially overpowered any anxiety he might have felt about the rabbit’s presence. Jones repeated the same procedure every day over a two-month period, each time sitting Peter in a high chair with candy and bringing the rabbit slightly closer than she had the time before, and Peter’s anxiety about rabbits eventually disappeared.

In general, counterconditioning involves the following components:

1. A new response that is incompatible with the existing conditioned response is chosen. Two responses are incompatible with each other when they cannot be performed at the same time. Because classically conditioned responses are often emotional in nature, an incompatible response is often some sort of opposite emotional reaction. For example, in the case of Little Peter, happiness was used as an incompatible response for fear. Since fear and anxiety create bodily tension, any response involving relaxation would be incompatible.

2. A stimulus that elicits the incompatible response must be identified; for example, candy elicited a ‘happy’ response for Peter. If we want to help someone develop a happy response to a stimulus that has previously elicited displeasure, we need to find a stimulus that already elicits pleasure—perhaps a friend, a party, or a favorite food. If we want someone to acquire a relaxation response, we might ask
that person to imagine lying in a cool, fragrant meadow or on a lawn chair by a swimming pool.

3. The stimulus that elicits the new response is presented to the individual, and the conditioned stimulus eliciting the undesirable conditioned response is gradually introduced into the situation. In treating Peter's fear of rabbits, Jones first gave Peter some candy; she then presented the rabbit at some distance from Peter, only gradually bringing it closer and closer in successive sessions. The trick in counterconditioning is to ensure that the stimulus eliciting the positive response is always stronger than the stimulus eliciting the negative response; otherwise, the negative response might prevail.1

Counterconditioning provides a means for decreasing or eliminating many conditioned anxiety responses. For example, systematic desensitization (Wolpe, 1958, 1969; Wolpe & Plaud, 1997), a therapeutic technique designed to replace anxiety with a relaxation response, is now widely used as a means of treating such difficulties as test anxiety and fear of public speaking (Hughes, 1988; Morris, Kratochwill, & Aldridge, 1988; Silverman & Keaney, 1991). I should point out, however, that treating test anxiety alone, without remediating possible academic sources of a student's poor test performance as well, may reduce test anxiety without any concurrent improvement in test scores (Covington, 1992; Naveh-Benjamin, 1991; Tryon, 1980).

A technique I recommend to many graduate students who dread their required statistics course because of mathematics anxiety is to find a math textbook that begins well below their own skill level—at the level of basic number facts, if necessary—so that the problems are not anxiety arousing. As they work through the text, the students begin to associate mathematics with success rather than failure. Programmed instruction is another technique that can be useful in reducing anxiety about a given subject matter, because it allows a student to progress through potentially difficult material in small, easy steps.

EDUCATIONAL IMPLICATIONS OF CLASSICAL CONDITIONING

The durability and generalizability of some classically conditioned responses point to the need for a positive classroom climate for our students beginning with day one. Students should experience academic tasks in contexts that elicit pleasant emotions—feelings of enjoyment, enthusiasm, or excitement, for instance—rather than in contexts that elicit anxiety, disappointment, or anger. When students associate academic subject matter with positive feelings, they are more likely to pursue it of their own accord. For example, when children's early experiences with books are enjoyable ones, they are more likely to read frequently and widely in later years (Baker, Scher, & Mackler, 1997).

When schoolwork, a teacher, or even the school environment itself is associated with punishment, humiliation, failure, or frustration, school and its curriculum can become sources of excessive anxiety. Some classroom activities—for example, tests, oral presentations, and difficult subject matter—are especially likely to be associated with unpleasant circumstances such as failure or embarrassment, and many students may soon become anxious when involved in them. Teachers should therefore take special precautions when asking students to engage in any such "risky" activities. For example, I suspect that many students have early unpleasant experiences in public speaking because they receive little if any instruction about how to prepare and deliver an effective oral presentation. If students are asked to speak in front of a group, they should be given specific suggestions regarding what material to present and how to present it in such a way that classmates will react favorably rather than derisively.

Mathematics is a difficult and anxiety-arousing subject for many students, and students often dislike it because they find it so frustrating (Stodolsky, Salk, & Glaessner, 1991). I firmly
believe that mathematics anxiety is so prevalent because most schools teach too much,
too fast, and too soon, so that students quickly begin to associate mathematics with frus-
tration and failure. Part of the problem may lie in the tendency to teach mathematical con-
cepts before children are cognitively ready to deal with them. For instance, many
developmental psychologists have proposed that the ability to understand the concept of
proportion, which underlies fractions and decimals, does not appear until age 11 or 12 at
the earliest (Schliemann & Carraher, 1993; Tourniaire & Pulos, 1985). Yet schools typically
introduce fractions and decimals sometime around fourth grade, when students are only 9
or 10 years of age.

Educators have often argued that school should be a place where a student encoun-
ters more success than failure, and classical conditioning provides a justification for their
argument. This is not to say that students should never encounter failure; people need
feedback about what they are doing wrong as well as what they are doing right. However,
when students experience failure too frequently, either in their schoolwork or in
their social relationships, school may quickly become a conditioned stimulus that leads to
such counterproductive conditioned responses as fear and anxiety. These responses, once
conditioned, may be very resistant to extinction and may interfere with a student’s ability
to learn effectively for years to come.

SUMMARY

Through a systematic study of salivation responses in dogs, Ivan Pavlov developed his the-
ey of classical conditioning—an explanation of how certain involuntary responses develop.
Classical conditioning occurs when two stimuli are presented at approximately the same
time. One is an unconditioned stimulus that already elicits an unconditioned response.
The second stimulus, through its association with the unconditioned stimulus, begins to
elicit a response as well. It becomes a conditioned stimulus that brings about a conditioned
response. If the conditioned stimulus is then presented numerous times in the absence of
the unconditioned stimulus, however, the conditioned response decreases and may even-
tually disappear (extinction); nevertheless, it may reappear after a period of rest (sponta-
neous recovery).

Once an organism has learned to make a conditioned response in the presence of one
conditioned stimulus, it may respond in the same way to a similar stimulus (stimulus gen-
eralization) unless that stimulus has repeatedly been experienced in the absence of the
unconditioned stimulus (stimulus discrimination). Classically conditioned associations can
build on one another through the processes of higher-order conditioning and sensory pre-
conditioning; in both cases, a stimulus may become a conditioned stimulus (eliciting a
conditioned response) not directly by its association with the unconditioned stimulus but
indirectly by its association with a stimulus that either has been or will be experienced in
conjunction with that UCS.

Contemporary psychologists propose that a contingent relationship between the con-
ditioned and unconditioned stimuli is more critical than a contiguous one. Many of them
speculate that the classical conditioning phenomenon involves the formation of associa-
tions between internal, mental representations of stimuli rather than associations between
the stimuli themselves.

The classical conditioning paradigm is frequently used to explain human fears such as
test anxiety, fear of failure, and school phobia, and it points to the importance of helping
students experience academic subject matter in contexts that elicit pleasant rather than
unpleasant emotions. Undesirable conditioned responses can sometimes be eliminated by
either extinction or counterconditioning.
In counterconditioning, we see similarities with two of Guthrie’s methods for breaking habits. In Guthrie’s *incompatible stimulus method*, a stimulus is presented in such a way that the usual response cannot occur and a more desirable response is likely to occur (remember his example of tying a dead chicken around a dog’s neck as a way of teaching it not to catch and eat chickens). In Guthrie’s *threshold method*, a stimulus is presented very faintly at first, so that it does not elicit the usual response, and then is so gradually increased in intensity that the organism continues not to respond to it.
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Contemporary Perspectives on Operant Conditioning
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Reinforcing Incompatible Behaviors
When Reinforcement Doesn’t Work

Taken from Human Learning, Third Edition by Ormrod.
Different individuals work for different rewards. When my son Alex needs money to buy something he wants desperately, he engages in behaviors he never does otherwise—for example, mowing the lawn or scrubbing the bathtub. In contrast, financial incentives rarely entice my son Jeff into doing household chores, yet he will readily clean up the disaster area he calls his bedroom if doing so enables him to have a friend spend the night.

The idea that rewards affect behavior has influenced psychologists’ thinking for at least 100 years; for example, Edward Thorndike’s law of effect dates back to 1898. The importance of rewards (or reinforcers, as many psychologists now prefer to call them) provides the foundation for B. F. Skinner’s principles of operant conditioning.

In this section, we will examine operant conditioning in depth. We will first look at the basic operant conditioning model and see how it differs from the classical conditioning model that we studied earlier. We will then examine concepts central to our understanding of operant conditioning—concepts such as extinction, shaping, positive versus negative reinforcement, and continuous versus intermittent reinforcement. As we consider the topic of stimulus control, we will find that, although reinforcers are stimuli that follow responses, stimuli that precede responses can influence behavior as well. Toward the end of the section, we will discuss several ways in which contemporary views of operant conditioning differ somewhat from Skinner’s original ideas, and we will apply operant conditioning principles to educational practice.

THE OPERANT CONDITIONING MODEL

We can paraphrase Skinner’s (1938) basic principle of operant conditioning as follows:

A response followed by a reinforcer is strengthened and is therefore more likely to occur again.

In other words, responses that are reinforced tend to increase in frequency. Because a response increase is a change in behavior, then, from a behaviorist viewpoint, reinforcement brings about learning. For example, Skinner found that rats will learn to press metal bars, and pigeons will learn to peck at round plastic disks, to get pellets of food. Likewise, my son Jeff will increase his housekeeping behavior if it allows him to see a friend, and my son Alex will do just about anything if the price is right.

Defining Reinforcers and Reinforcement

Skinner intentionally used the term reinforcer instead of reward to describe a consequence that increases the frequency of a behavior. The word reward implies that the stimulus following a behavior is somehow both pleasant and desirable, an implication that Skinner tried to avoid for two reasons. First, some individuals will work for what others see as unpleasant consequences; for example, my daughter Tina occasionally does something she knows will irritate me because she enjoys watching me blow my stack. Second, ‘pleasantness’ and ‘desirability’ are subjective judgments, and behaviorists such as Skinner prefer that psychological principles be restricted to the domain of objectively observable events. A reinforcer can be defined without any allusion to either pleasantness or desirability in this way.
A reinforcer is a stimulus that increases the frequency of a response it follows. (The act of following a response with a reinforcer is called reinforcement.)

Notice how I have just defined a reinforcer totally in terms of observable phenomena, without reliance on any subjective judgment.

Now that I have given you definitions of both operant conditioning and a reinforcer, I need to point out a major problem with my definitions: Taken together, they constitute circular reasoning. I have said that operant conditioning is an increase in a behavior when it is followed by a reinforcer, but I cannot seem to define a reinforcer in any other way except to say that it increases behavior. I am therefore using reinforcement to explain a behavior increase, and a behavior increase to explain reinforcement! Fortunately, a paper by Meehl (1950) has enabled learning theorists to get out of this circular mess by pointing out the transituational generality of a reinforcer: The same reinforcer will increase many different behaviors in many different situations.

Three Important Conditions for Operant Conditioning

Three important conditions are necessary for operant conditioning to occur:

- The reinforcer must follow the response. "Reinforcers" that precede a response rarely have an effect on that response. For example, many years ago, a couple of instructors at my university were concerned that grades, because they were "threatening," interfered with student learning; therefore, they announced on the first day of class that everyone would receive an A for the course. Many students never attended class after that first day, so there was little learning for any grade to interfere with. Reinforcers must always, always follow the desired behavior.

- The reinforcer must follow immediately. A reinforcer tends to reinforce the response that has occurred just before it. Thus, reinforcement is less effective when its presentation is delayed: In the meantime, an organism may have made one or more responses that are reinforced instead. Once, when I was teaching a pigeon named Ethel to peck a lighted plastic disk, I made a serious mistake: I waited too long after she had pecked the disk before reinforcing her, and in the meantime she had begun to turn around. After eating her food pellet, Ethel began to spin frantically in counterclockwise circles, and it was several minutes before I could get her back to the pecking response I had in mind for her.

- Our schools are notorious for delayed reinforcement. How many times have you completed an exam or turned in a written assignment, only to receive your grade days or even weeks later? Immediate reinforcers are typically more effective than delayed reinforcers in classroom situations (Kulik & Kulik, 1988). Furthermore, immediate reinforcers are probably the only effective reinforcers for animals and young children.

- The reinforcer must be contingent on the response. A reinforcer should never be presented unless the desired response has occurred. For example, teachers often specify certain conditions that children must meet before going on a field trip: They must bring their permission slips, they must complete previous assignments, and so on. When these teachers feel badly for children who have not met the stated conditions and allow them to go on the field trip anyway, the reinforcement is not contingent on the response, and the children are not learning acceptable behavior. If anything, they are learning that rules can be broken.

What Behaviors Can Be Reinforced?

Virtually any behavior—academic, social, or psychomotor—can be learned or modified through operant conditioning. As a teacher, I keep reminding myself of what student behaviors I want to increase and try to follow those behaviors with positive consequences. For example, when typically quiet students raise their hands to answer a question or make a comment, I call on them and give them whatever positive feedback I can. I also try to make my classes lively, interesting, and humorous, as well as informative, so that students are reinforced for coming to class in the first place.
Unfortunately, undesirable behaviors can be reinforced just as easily as desirable ones. Aggression and criminal activity often lead to successful outcomes: Crime usually does pay. Disruptive behavior in the classroom may get the teacher’s attention in a way that no other behavior can (e.g., Taylor & Romanczyk, 1994). Getting “sick” allows the school-phobic child to stay home from school. Students sometimes appear at my office at the end of the semester pleading for a higher grade than their class performance has warranted or for the chance of completing an extra-credit project. I almost invariably turn them down, for a simple reason: I want good grades to be contingent on good study habits throughout the semester, not on begging behavior at my office door. Teachers must be extremely careful about what they reinforce and what they do not.

**CONTRASTING OPERANT CONDITIONING AND CLASSICAL CONDITIONING**

Skinner suggested that there are really two different kinds of learning: classical conditioning (he used the term *respondent conditioning*) and operant conditioning. The two forms of conditioning are different in several major respects; these differences are summarized in Figure 2–4.

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### Classical Conditioning vs. Operant Conditioning

<table>
<thead>
<tr>
<th>Occurs when:</th>
<th>Two stimuli (UCS and CS) are paired</th>
<th>A response (R) is followed by a reinforcing stimulus ($S_{ref}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature of response:</td>
<td>Involuntary: elicited by a stimulus</td>
<td>Voluntary: emitted by the organism</td>
</tr>
<tr>
<td>Model:</td>
<td>$CS \rightarrow CR$</td>
<td>$R \rightarrow S_{ref}$</td>
</tr>
</tbody>
</table>

---

Classical conditioning results from the pairing of two stimuli, the UCS and the CS. The learned response is a direct and immediate reaction to the stimulus that precedes it; that is, the conditioned stimulus brings about, or elicits, the conditioned response. The conditioned response is automatic and involuntary, such that the organism has virtually no control over what it is doing. Skinner’s term *respondent* reflects the fact that the organism’s behavior is an involuntary response to a stimulus.

In contrast, operant conditioning results when a response is followed by a reinforcing stimulus. The response is a voluntary one emitted by the organism, with the organism having complete control over whether the response occurs. Skinner’s term *operant* reflects the fact that the organism voluntarily operates on, and thereby has some effect on, the environment. Because operant conditioning reflects a $R \rightarrow S_{ref}$ model, where $S_{ref}$ symbolizes a reinforcing stimulus, Skinner was not really an S-R psychologist at all—he was actually an R-S psychologist.

Some theorists have suggested that both classical and operant conditioning are based on the same underlying learning processes (e.g., see Bower & Hilgard, 1981). In most situations, however, the classical and operant conditioning models are differentially useful in explaining different learning phenomena, so many psychologists continue to treat them as two distinct forms of learning.
BASIC CONCEPTS IN OPERANT CONDITIONING

Several concepts are central to our understanding of operant conditioning, including free operant level, terminal behavior, extinction, superstitious behavior, shaping, and chaining. Let’s look briefly at each of them.

Free Operant Level (Baseline)

As we noted earlier, an operant is a voluntary response that has a particular effect on the environment. The free operant level is the frequency of an operant in the absence of reinforcement; in other words, it is the pre-reinforcement, or baseline, frequency of that response. People vary in their free operant levels for different responses. For example, for some students, getting-out-of-seat behavior is quite frequent, whereas for others it is rare. Similarly, some students read frequently without being asked to do so, whereas others seldom read on their own initiative.

Terminal Behavior

The terminal behavior is the form and frequency of a desired response at the end of a planned reinforcement program. Let’s say, for example, that a second-grade boy rarely stays in his seat for more than five minutes at a time, and when he does sit down, he slouches so low in the chair that his head is barely level with the desk. A teacher who plans to alter this child’s classroom behavior through reinforcement might specify the terminal behavior as “sitting up straight for a 10-minute period.”

When we use reinforcement to change behavior, it is essential that we describe the terminal behavior in concrete terms ahead of time. Specifying the exact form of the desired behavior (e.g., sitting up straight) and the frequency or duration of the behavior (e.g., 10 minutes at a stretch) enables us to determine objectively whether our reinforcement program has been effective.

Extinction

In classical conditioning, when the CS is repeatedly presented in the absence of the UCS, the CR decreases and eventually disappears—that is, the response is extinguished. In operant conditioning, extinction occurs when a response is no longer followed by a reinforcer. A nonreinforced response gradually decreases and eventually returns to its baseline rate. For example, class clowns who find that no one laughs at their jokes anymore are likely to decrease their joke telling. Students who are never called on when they raise their hands may stop trying to participate in class discussions. Students who continue to fail exams despite hours of studying may eventually stop studying.

We should note here that in the initial stages of the extinction process we may sometimes see a brief increase in the behavior being extinguished—a phenomenon known as an extinction burst (Lerman & Iwata, 1995). We may also see increased variability in the kinds of responses exhibited (Rachlin, 1991). For example, students who find themselves doing poorly on exams may try studying more or studying differently; if such efforts continue to meet with failure, however, their studying behavior will eventually decrease and perhaps disappear altogether.

Although we want to extinguish undesirable behaviors such as disruptive joke telling, we need to take precautions that desirable behaviors are reinforced frequently enough that they don’t extinguish. For example, if we see students failing classroom exams time after time despite their best efforts, we should look for the root of the problem. If only one student is failing, perhaps that student needs help in developing more appropriate study techniques, more individualized instruction, or placement in a situation better matched to his or her current knowledge and skills. If many other students find the same exams too difficult to pass, something may be wrong with those tests or with classroom instruction.
**Superstitious Behavior**

What happens when reinforcement is random and not contingent on any particular behavior? Skinner once left eight pigeons in their cages overnight with the food tray mechanism adjusted to present reinforcement at regular intervals, regardless of what responses the pigeons were making at the time. By morning, six of the pigeons were acting bizarrely. For example, one repeatedly thrust its head into an upper corner of the cage, and two others were swinging their heads and bodies in rhythmic pendulum movements (Skinner, 1948a).

Randomly administered reinforcement tends to reinforce whatever response has occurred immediately beforehand, and an organism will increase that response, thus displaying what Skinner called superstitious behavior. A nonbehaviorist way of describing the learning of a superstitious behavior is that the organism thinks that the response and reinforcement are related, when in fact they are not. For example, a student may have a "lucky sweater" to wear on exam days, or a football player may, before every game, perform a ritual totally unrelated to successful football play.

Superstitious behavior in the classroom can occur either when reinforcement is not contingent on behavior or when students do not know which of their many responses are responsible for bringing about reinforcement. It behooves teachers to ensure that classroom reinforcers such as praise, attention, and grades are contingent on desired behaviors and that response-reinforcement contingencies are clearly specified.

**Shaping**

Before we can reinforce someone for exhibiting a particular response, he or she must first make that response. But sometimes an individual's free operant level of a response is so low that it rarely, if ever, occurs. What should we do then?

To handle such a situation, Skinner introduced a method called shaping, a technique also known as successive approximations. Shaping is a means of teaching a behavior when the free operant level for that behavior is very low or when the desired terminal behavior is different in form from any responses that the organism exhibits.

To shape a particular behavior, we begin by reinforcing the first response that in any way approximates the desired behavior and then continue to reinforce it until the organism is emitting it fairly frequently. At that point, we reinforce only those responses that more closely resemble the desired behavior, then those that resemble it more closely still, until eventually only the desired behavior itself is being reinforced. In other words, shaping is a process of reinforcing successively closer and closer approximations to the terminal behavior until the terminal behavior is exhibited.

To illustrate, when I taught my pigeon Ethel to peck a lighted disk in her Skinner box, I began by reinforcing her every time she faced the wall on which the disk was located. Once this response was occurring frequently, I began to reinforce her only when she moved her beak near the wall, then only when she touched the wall with her beak, then only when she pecked within a two-inch radius of the disk, and so on. Within an hour, I had Ethel happily pecking the lighted disk and eating the food pellets that followed each correct peck.

Legend has it that a group of students once shaped a professor of mine a few days after he had given a lecture on shaping. Every time the professor stood on the side of the classroom near the door, the students all appeared interested in what he was saying, sitting forward in their seats and taking notes feverishly. Every time he walked away from the door, they acted bored, slouching back in their seats and looking anxiously at their watches. As the class went on, they reinforced the professor only as he moved closer and closer to the door until, by the end of class, he was lecturing from the hallway!

In much the same way, teachers gradually shape such behaviors as handwriting, sedentary behavior, and mathematical problem solving as children move through the grade levels. For example, kindergarten children are taught to print their letters on wide-lined paper; they are praised for making well-formed letters and for letters whose bottoms rest on one line.
and whose tops touch the line above. As children progress through the primary grades, the spaces between the lines become smaller, and teachers are more particular about how well the letters are written. Gradually children begin to write consistently sized and carefully shaped letters with the benefit of only a lower line, and eventually with no line at all. Teachers also shape the sedentary behavior of their students: As students grow older, teachers expect them to sit quietly in their seats for longer and longer periods. We can think of mathematics as a shaped behavior, too: Teachers introduce complex problem solving only after students have mastered more basic skills, such as counting, number recognition, and addition.

In a similar manner, teachers may inadvertently shape undesirable behavior as well. For example, let’s say that Molly frequently exhibits such disruptive responses as talking out of turn and physically annoying other students. Molly’s teacher, Mr. Smith, realizes that, because he has been reprimanding her for these responses, he has actually been giving her the attention that he knows she craves and so in essence has been reinforcing her for her disruptiveness. Mr. Smith decides to eliminate Molly’s disruptive behavior by ignoring it—in other words, by using extinction. Unfortunately, although Mr. Smith can easily ignore minor infractions, he finds himself unable to ignore more extreme disruptions and so reprimands Molly for them. Rather than extinguishing Molly’s disruptive behavior, then, Mr. Smith is actually shaping it: He is insisting that Molly be very disruptive, rather than just a little disruptive, in order to get reinforcement.

Chaining

In many cases, organisms can learn a sequence, or chain, of responses through shaping. For example, when visiting a tourist trap many years ago, I watched a chicken play a solitary game of “baseball.” As soon as the chicken heard the appropriate signal (triggered by the quarter I deposited in the side of its cage), it hit a ball with a horizontal bar (a bat of sorts) that it could swivel at home plate, then ran counterclockwise around a three-foot-square baseball diamond back to home plate again (at which point it found some food in its feeding tray). The chicken’s trainer had probably taught the chicken this complex chain of responses by first reinforcing only the last response in the sequence (running to home plate), then reinforcing the last two responses (running to third base and then to home plate), then reinforcing the last three (running to second base, third base, and then home plate), and so on, eventually reinforcing only the entire sequence.

This process of teaching a chain of responses by first reinforcing just one response, then reinforcing two responses in a row, then reinforcing a sequence of three, and so on is known as chaining. Just as a chicken can learn to play baseball, so, too, can people learn lengthy, fairly complex behaviors through chaining. For example, students in a tennis class might learn to hold their rackets a certain way, then stand with their feet apart facing the net as they watch for the ball, then move toward an approaching ball and adjust their position appropriately, and then swing their rackets to meet the ball. Similarly, students in a first-grade classroom might learn to put their work materials away, sit quietly at their desks, and then line up single file at the classroom door before going to lunch. Such complex actions are often acquired more easily one step at a time—in other words, through chaining.

THE NATURE OF REINFORCERS

We have talked at length about how reinforcers can be used to change behavior. It is time now to talk more about reinforcers themselves. Let’s first distinguish between primary and secondary reinforcers and between positive and negative reinforcement (which we will also contrast with punishment). We will then consider the different kinds of reinforcers teachers can use to change student behavior.
Primary and Secondary Reinforcers

A primary reinforcer is one that satisfies a biological need. Food, water, oxygen, and warmth are all examples of possible primary reinforcers. Physical affection and cuddling may also address biological needs (Harlow & Zimmerman, 1959), thus serving as primary reinforcers. Individual differences may exist regarding the consequences that serve as primary reinforcers; for example, sex is reinforcing to some individuals but not to others, and a particular drug is a primary reinforcer for a drug addict but not necessarily for a nonaddicted individual.

A secondary reinforcer, also known as a conditioned reinforcer, is a previously neutral stimulus that has become reinforcing to an organism through repeated association with another reinforcer (e.g., Wolfe, 1936). Examples of secondary reinforcers, which do not satisfy any obvious biological necessities, are praise, grades, money, and feelings of success.

Why do secondary reinforcers become reinforcing? An early explanation was that some stimuli become secondary reinforcers through the process of classical conditioning. A neutral stimulus is paired with an existing reinforcer (UCS) that elicits some form of biological satisfaction (UCR). That neutral stimulus becomes a CS (i.e., it becomes a secondary reinforcer) that elicits the same satisfaction (CR). For example, my daughter Tina learned very early that she could use money (CS) to buy candy (UCS) to satisfy her sweet tooth. The more often a secondary reinforcer has been associated with another reinforcer and the stronger that other reinforcer is, the more powerful the secondary reinforcer will be (Bersh, 1951; D’Amato, 1955).

More recently, some theorists have proposed that secondary reinforcers are effective to the extent that they give an organism information that a primary reinforcer is coming (Bower, McLean, & Meachem, 1966; Green & Rachlin, 1977; Mazur, 1993; Perone & Baron, 1980). This explanation has a decidedly cognitive flavor to it: An organism is seeking information about the environment rather than just responding to that environment in a thoughtless manner.

The relative influences of primary and secondary reinforcers on our lives probably depend a great deal on economic circumstances. When such biological necessities as food and warmth are scarce, these primary reinforcers, as well as the secondary reinforcers closely associated with them (e.g., money), may be major factors in reinforcing behavior. But in times of economic well-being, when cupboards are full and houses are warm, such secondary reinforcers as praise, grades, and feelings of success are more likely to play a major role in the learning process.

Positive Reinforcement, Negative Reinforcement, and Punishment

In addition to distinguishing between primary and secondary reinforcers, we can also distinguish between positive and negative reinforcement. Let’s examine these two forms of reinforcement and look at how they differ from punishment.

Positive Reinforcement

Up to this point, the reinforcers I have mentioned have all been positive reinforcers. Positive reinforcement involves the presentation of a stimulus after the response. Food, praise, a smile, and success are all positive reinforcers.

Negative Reinforcement

In contrast to positive reinforcement, negative reinforcement increases a response through the removal of a stimulus, usually an aversive or unpleasant one. For example, when rats learn to press a bar to terminate an electric shock, removal of the aversive shock is negative reinforcement that increases bar pressing. As another example, many cars sound a loud buzzer if the keys are still in the ignition when the driver’s door is opened; removal
of the keys from the ignition is negatively reinforced (so will presumably increase in fre-
quency) because the buzzer stops.

The removal of guilt or anxiety can be an extremely powerful negative reinforcer.

A child may confess to a crime committed days or even weeks earlier because she has
been feeling guilty about the transgression all that time and needs to get it off her chest.
Anxiety may drive one student to complete a term paper early, thereby removing an item from
his things-to-do list. Another student confronted with the same term paper might procrasti-
nate until the last minute, thereby removing anxiety—although only temporarily—about
the more difficult aspects of researching and writing that paper.

We must keep in mind that negative reinforcement can affect the behavior of teachers
as well as that of students. Teachers may often behave in ways that remove aversive stimuli;
for example, they may use classroom discipline strategies (responses such as yelling at stu-
dents or promising less homework) that eliminate unpleasant stimuli (disorderly conduct in
the classroom) over the short run but that are ineffective over the long run. As an illus-
tration, if Ms. Jones yells at Marvin for talking too much, Marvin may temporarily stop talking,
which negatively reinforces Ms. Jones’s yelling behavior. But if Marvin likes getting Ms. Jones’s
attention (a positive reinforcer for him), he will be chattering again before very long.

**Punishment**

Both positive reinforcement and negative reinforcement increase the responses that they
follow. **Punishment**, on the other hand, is likely to decrease those responses. We will con-
sider the effects of punishment in more detail later, but let’s briefly define punishment
here so you can see how it differs from negative reinforcement.

Punishment takes one of two forms, frequently referred to as Punishment I and Pun-
ishment II. **Punishment I** involves the presentation of a stimulus, usually an aversive
one. Scolding and spanking are examples of this form of punishment. **Punishment II**
involves the removal of a stimulus, usually a pleasant one. Examples include fines for mis-
behaviors (because money is being taken away) and loss of privileges. Figure 2–5 illustrates
the differences among positive reinforcement, negative reinforcement, Punishment I, and
Punishment II.

<table>
<thead>
<tr>
<th>Stimulus is</th>
<th>Nature of Stimulus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presented after the response</td>
<td>Pleasant</td>
</tr>
<tr>
<td>Positive Reinforcement (response increases)</td>
<td>Punishment I (response decreases)</td>
</tr>
<tr>
<td>Removed after the response</td>
<td>Punishment II (response decreases)</td>
</tr>
</tbody>
</table>

**Figure 2–5**

Positive reinforcement, negative reinforcement, and punishment.

Many people mistakenly use the term **negative reinforcement** when they are really
talking about punishment. Although both phenomena involve aversive stimuli, they differ
in two critical respects. First, as we just noted, they have opposite effects: Negative rein-
forcement increases the frequency of a response, whereas punishment often decreases the
frequency of a response. A second crucial difference concerns the order of events. With neg-
ative reinforcement, the aversive stimulus stops when the response is emitted. With Pun-
ishment I, on the other hand, the aversive stimulus begins when the response is emitted.
Figure 2–6 illustrates this difference graphically. The termination of an aversive stimulus negatively reinforces a response; the initiation of an aversive stimulus punishes a response.

**Different Kinds of Reinforcing Stimuli**

When using reinforcement in the classroom, teachers often unnecessarily limit themselves to just a handful of reinforcers. In fact, a wide variety of events can be reinforcing to students. Let’s look at several possibilities.

**Material Reinforcers**

A material reinforcer, or tangible reinforcer, is an actual object; food and toys are examples. For many people, the word reinforcer brings to mind such tangible consequences for good behavior. But in school situations at least, most psychologists recommend that we use material reinforcers only as a last resort, when absolutely no other reinforcer works. Food, toys, trinkets, and similar items have a tendency to distract students’ attention from the things they should be doing in class and so may be counterproductive over the long run.

**Social Reinforcers**

A social reinforcer is a gesture or sign from one person to another that communicates positive regard. Praise, a smile, a pat on the back, and a hug are all social reinforcers. Social reinforcement is a common occurrence in the classroom and can be quite effective. Teacher attention, approval, praise, and appreciation are powerful classroom reinforcers (Becker, Madsen, Arnold, & Thomas, 1967; Drabman, 1976; Katz, 1993; Madsen, Becker, & Thomas, 1968; Schepis, Reid, & Fitzgerald, 1987; Ward & Baker, 1968). The approval of peers can be effective as well (Evans & Oswalt, 1968; Lovitt, Guppy, & Blattner, 1969).

**Activity Reinforcers**

Speaking nonbehavioristically, an activity reinforcer is an opportunity to engage in a favorite activity. (A quick quiz: Which word is the nonbehaviorist part of my definition, and why?) David Premack (1959, 1963) discovered that people will often perform one activity if doing so enables them to perform another. His Premack principle for activity reinforcers is as follows:

> A normally high-frequency response, when it follows a normally low-frequency response, will increase the frequency of the low-frequency response.

A high-frequency response is, in essence, a response that an organism enjoys doing, whereas a low-frequency response is one that the organism does not enjoy. Another way of stating the Premack principle, then, is that organisms will perform less-preferred tasks so that they can subsequently engage in more-preferred tasks.

To illustrate, my own free operant level for housework is extremely low. I have found that I am more likely to do household chores if I make a higher-frequency behavior, such as reading a mystery novel or having a party, contingent on doing the housework. In a sim-
ilar way, appropriate classroom behavior can be improved through the Premack principle. Young children can quickly be taught to sit quietly and pay attention if they are allowed to engage in higher-frequency “active” behaviors (e.g., talking and running around the room) only after they have been quiet and attentive for a certain period of time (Homme, deBaca, Devine, Steinhorst, & Rickert, 1963).

Although psychologists agree that the Premack principle works, they disagree as to why it works. If you are interested in exploring the theoretical underpinnings of the Premack principle, see the discussions by Bower and Hilgard (1981) and Timberlake and Allison (1974).

Intrinsic Reinforcers

In many situations, individuals engage in certain responses not because of any external reinforcers but because of the internal good feelings—the intrinsic reinforcers—that such responses bring. Feeling successful after solving a difficult puzzle, feeling proud after returning a valuable item to its rightful owner, and feeling relieved after completing a difficult assignment are all examples of intrinsic reinforcers. People who continue to engage in responses for a long time without any obvious external reinforcers for their efforts are probably working for intrinsic sources of satisfaction.

Positive Feedback

In some instances, material and social reinforcers may improve classroom behavior and lead to better learning of academic skills because they provide feedback to students about which responses are desirable and which are not (Butler, 1987; Gagné & Driscoll, 1988). Positive feedback is clearly effective in bringing about desired behavior changes (Lhyle & Kulhavy, 1987; Smith & Smoll, 1997).

I once spent a half hour each day for several weeks working with Michael, a nine-year-old boy with a learning disability who was having difficulty learning his cursive letters. Over the first three weeks, neither Michael nor I could see any improvement, and we were both becoming increasingly frustrated. To give ourselves more concrete feedback on the results of our sessions together, I decided to start graphing Michael’s daily performance. I explained to Michael how we would chart his progress on a piece of graph paper by marking off the number of cursive letters he could remember each day. I also told him that as soon as he had reached a dotted line near the top of the page (a line indicating that he had written all 26 letters correctly) for three days in a row, he could have a special treat (his choice was a purple felt-tip pen).

At the beginning of each subsequent work session, I tested Michael on his cursive letters, and together we counted the number that he had correctly remembered. We entered his performance on the chart in the form of a bar of the appropriate height, and then Michael practiced the letters he had missed. Michael’s daily performance began to improve dramatically. He was not only making noticeable progress but also looking forward to charting his performance and seeing a higher bar each day. Within two weeks, Michael had successfully met the criterion for his felt-tip pen. He had written all 26 cursive letters for three days in succession. As it turns out, the pen was probably not the key ingredient for our success: Michael lost it within 24 hours of receiving it. Instead, I suspect that the concrete positive feedback about his own improvement was the true reinforcer that helped Michael to learn.

Feedback is especially likely to be effective when it communicates what students have and have not learned and when it gives them guidance about how they might improve their performance (Butler & Winne, 1995; Lhyle & Kulhavy, 1987). Under such circumstances, even negative feedback can lead to enhanced performance (e.g., Barbeta, Heward, Bradley, & Miller, 1994). Interpreting such findings within a strictly behaviorist framework is difficult, however; it appears that students must be thinking about the specific meaning of the feedback they receive and using it to adjust their future behavior.

For many students, the true reinforcers for learning are probably the internal reinforcers—the feelings of success, competence, mastery, and pride—that their accomplishments bring. For such students, other reinforcers are more helpful if they provide feedback that acade-
mic tasks have been performed well. Grades are probably also reinforcing for the same reason: good grades reflect high achievement—a reason to feel proud.

From a teacher’s perspective, positive feedback and the intrinsic reinforcement that such feedback brings are probably the most desirable forms of classroom reinforcement. Keep in mind, however, that consistent positive feedback and resulting feelings of success and mastery can occur only when instruction has been carefully tailored to individual skill levels and abilities and only when students have learned to value academic achievement. When, for whatever reasons, children are not motivated to achieve academic success, then other reinforcers, such as social and activity reinforcers, can be helpful.

Always remember that what is reinforcing for one individual may not be reinforcing for another. Reinforcement, like beauty, is in the eyes of the beholder. And even for the same individual, a reinforcer on one occasion may not be a reinforcer on another. Several other factors influence the effectiveness of reinforcers, as we shall now see.

FACTORS INFLUENCING THE EFFECTIVENESS OF REINFORCEMENT

At least three factors influence the effectiveness of reinforcement in operant conditioning: timing, magnitude and appeal, and consistency.

Timing

Earlier in the section, I stressed the importance of immediate reinforcement for operant conditioning. In most cases, greater delays in reinforcement lead to slower acquisition of responses (e.g., Hockman & Lipsitt, 1961; Lett, 1973, 1975; Terrell & Ware, 1961). Fortunately, in situations in which immediate reinforcement is impossible, environmental cues that indicate that reinforcement, although delayed, will come eventually may be helpful (Fowler & Baer, 1981; Perin, 1943). For example, a teacher who wants to reinforce her students’ persistence through a difficult lesson might say, “Because we have all worked so hard this morning, we will spend this afternoon practicing the class play that you all have been enjoying so much.”

Magnitude and Appeal

The larger and more appealing the reinforcer, the faster a response will be learned and the more frequently it will be exhibited (e.g., Atkinson, 1958; Siegel & Andrews, 1962). For example, in a study by Siegel and Andrews (1962), three- to five-year-old boys learned more quickly when they were reinforced with such treats as candy, coins, balloons, and small toys than when the reinforcers were unexciting buttons. In fact, for older children and adults, large, delayed rewards are often more effective than small, immediate ones, provided that the individuals know that those delayed rewards will in fact be coming (e.g., Green, Fry, & Myerson, 1994).

Interestingly enough, it is not always the absolute magnitude of reinforcement that affects behavior as much as it is the relative magnitude compared with prior experience. For example, in a classic study by Crespi (1942), rats ran a runway to reach a food reinforcer at the far end. When rats accustomed to a small quantity of food were suddenly reinforced with a greater amount, they ran faster than rats who had always received that same large amount. Similarly, rats accustomed to a large amount of reinforcement who then began receiving less food ran more slowly than rats who had always had that smaller
amount. Crespi’s results have been replicated in other rat studies (e.g., McHale, Brooks, & Wolach, 1982), although the results of analogous studies with infants have been inconsistent (e.g., Fagen & Rovee, 1976; Lipsitt & Kaye, 1965).

The changes in behavior observed when quantities of reinforcement increase or decrease are commonly known as contrast effects. One contrast effect—the elation effect—occurs when the amount of reinforcement is increased. The response rate becomes faster than it would be if the reinforcement had always been at that higher level. The opposite contrast effect—the depression effect—occurs when the amount of reinforcement is decreased. The result is that the response rate becomes slower than it would be if reinforcement had always been that low. The depression effect may be at least partly due to negative emotions associated with a reduction in reinforcement (Flaherty, 1985).

Consistency

One of the most critical factors affecting both the rate at which responses are learned and the rate at which they can be extinguished is the consistency of reinforcement (e.g., Staddon & Higa, 1991). To illustrate how consistency plays a role, consider this fantasy I have for the handful of students in my classes each semester who don’t read their textbook:

The student is locked in a small room. The assigned textbook lies on a nearby table. Every time the student opens the book to one of the assigned pages and looks at the page, a small piece of delicious junk food falls from a hole in the ceiling.

Essentially, I would like to put unmotivated students into my own version of a Skinner box—the Ormrod box!

Now imagine 20 students in 20 Ormrod boxes. Ten of these students, randomly selected, are in group A. They receive a piece of junk food every time they open the textbook and look at it. The other 10 are in group B. They get junk food for some of their book-reading responses (perhaps one response out of every four) but receive nothing for their efforts the rest of the time. Group A is receiving continuous reinforcement: Every response is reinforced. Group B is receiving intermittent reinforcement: Some of the responses are reinforced and some are not. Which group is going to increase its textbook-reading behavior faster? The answer, of course, is group A, the group with continuous reinforcement. Continuously reinforced responses are acquired faster than intermittently reinforced responses.

Now suppose that, after a few hours in their respective Ormrod boxes, all 20 students have begun to show a high frequency of textbook-reading responses, so I turn off the junk-food-dropping mechanisms. Which students are first going to notice that they are no longer being reinforced? The answer again is group A. Students who have been reinforced for every single response will notice rather quickly that reinforcement has stopped, and their textbook reading should extinguish rapidly (unless, of course, they find such behavior intrinsically reinforcing). Group B students, on the other hand, have been receiving reinforcement for only 25% of their responses, so they are accustomed to nonreinforcement; these students will probably continue to read their textbooks for some time before they realize that reinforcement has ceased. Intermittently reinforced responses are extinguished more slowly than continuously reinforced responses.

Psychologists usually recommend reinforcing a response continuously until the terminal behavior is reached and then maintaining the response through intermittent reinforcement so that it does not extinguish. Intermittent reinforcement can follow a variety of reinforcement schedules, each of them having different effects on resistance to extinction and on the frequency and pattern of the response being reinforced. Let’s take a look at several different schedules and the behavior patterns that result from each one.
SCHEDULES OF REINFORCEMENT

In this section I describe three different groups of intermittent reinforcement schedules: ratio schedules (those in which reinforcement occurs after a certain number of responses), interval schedules (those in which reinforcement occurs for the first response after a certain time interval has elapsed), and differential schedules (those in which reinforcement is contingent on a certain rate of responding).

Ratio Schedules: Reinforcing a Certain Number of Responses

A ratio schedule is one in which reinforcement occurs after a certain number of responses have been emitted. That certain number can either be constant (a fixed-ratio schedule) or vary from one reinforcement to the next (a variable-ratio schedule).

Fixed Ratio (FR)

In a fixed-ratio reinforcement schedule, a reinforcer is presented after a certain constant number of responses have occurred. For example, reinforcement might occur after every third response (a 1:3 ratio schedule) or after every fiftieth response (a 1:50 schedule). Such a reinforcement schedule can lead to a high and consistent response rate over an indefinite period of time; for example, pigeons whose pecking is maintained on a high ratio schedule will peck as often as 10 times per second (Ferster & Skinner, 1957).

Whitlock (1966) has described the use of a series of ratio schedules with a six-year-old boy who had been unable to acquire basic reading skills. At first, the boy was asked to read words presented to him on flash cards. Every time he read a word correctly, he received a plastic poker chip as a reinforcer, reflecting a continuous reinforcement schedule. He could then trade jars of 36 poker chips for a variety of activities; for example, with two jars he could play a game, and with seven jars he could watch a cartoon. Once the boy was able to read from beginning reader storybooks, he was reinforced on a 1:2 fixed-ratio schedule; that is, he received one chip for every two words he read correctly. Eventually he was reinforced for every four words (a 1:4 schedule), then for every page (one reinforcer for every 10 to 25 words), then for every story (one reinforcer for every 50 to 70 words), and finally for every four stories. After 15 sessions of such individualized instruction, reinforcement was phased out altogether, and the boy was placed in his classroom's regular reading program; three months later, he was still reading at grade level. (One thing has always struck me about this study: Because so many poker chips were required to make a ‘purchase,’ the boy must have actually bought very few activities. I suspect that his increasing success in reading was the true reinforcer in this case.)

Ratio schedules even as high as 1:1000, when introduced through a series of successively higher ratios (as was done in the Whitlock study), have been found to maintain a response (Ferster & Skinner, 1957). In fact, high ratios typically lead to higher rates of responding than low ratios (Collier, Hirsh, & Hamlin, 1972; Stephens, Pear, Wray, & Jackson, 1975), although organisms operating under high ratio schedules tend to exhibit a post-reinforcement pause (a temporary decrease in responding) after each reinforced response (Ferster & Skinner, 1957).

Variable Ratio (VR)

A variable-ratio reinforcement schedule is one in which reinforcement is presented after a particular, yet changing, number of responses have been emitted; this kind of schedule is described by the average number of responses needed to obtain reinforcement. For example, in a 1:5 VR schedule, reinforcement might first take place after four responses, then after seven more, then after three, and so on. As you can see, the occurrence of reinforcement in a VR schedule is somewhat unpredictable.
Playing a Las Vegas slot machine is an example of a response that is reinforced on a variable-ratio schedule. The more times you put a quarter into the machine, the more times you will be reinforced by having quarters come back out again, but those quarters do not come out after any predictable number of quarters have gone in. In a similar way, telephone solicitation is also reinforced on a VR schedule. The greater the number of calls made, the greater the number of sales, but the soliciting caller never knows just which call will lead to reinforcement.

Margaret, one of my daughter Tina’s friends, has always been very persistent when she wants something; she seldom takes no for an answer. The source of her persistence became clear to me one evening many years ago when Tina and I had dinner at a restaurant with Margaret and her mother. The girls gobbled their food quickly and went off to explore the restaurant while we ladies nursed our coffee. Margaret quickly returned to the table to make a request of her mother:

"Mom, can I have a quarter for a video game?"
"No."
"Please, mom?"
"I said no, Margaret."
"But Tina has one." (I look absentmindedly into space.)
"No."
"I’ll pay you back as soon as we get home."
"No, Margaret."
"Pretty please?" (Margaret puts on a desperate face.)
"Oh, all right, here’s a quarter."

Margaret’s asking behaviors were probably on a variable-ratio reinforcement schedule: She had learned that persistence eventually paid off.

Variable-ratio schedules result in higher response rates than fixed-ratio schedules. Furthermore, responses reinforced on a VR schedule are highly resistant to extinction. In fact, pigeons working on very high VR schedules may expend more energy responding than they gain in food reinforcement, thus eventually working themselves to death (Swenson, 1980).

Interval Schedules: Reinforcing the First Response after a Time Period

An interval schedule is one in which reinforcement is contingent on the first response emitted after a certain time interval has elapsed. The time interval can either be constant (a fixed-interval schedule) or vary from one reinforcement to the next (a variable-interval schedule).

Fixed Interval (FI)

With a fixed-interval reinforcement schedule, reinforcement is contingent on the first response emitted after a certain fixed time interval has elapsed. For example, the organism may be reinforced for the first response emitted after five minutes have elapsed, regardless of how many responses may or may not have been made during those five minutes. Following reinforcement, another five-minute interval must elapse before a response is again reinforced.

A fixed-interval schedule produces a unique response pattern: Following reinforcement, the response rate tapers off in a post-reinforcement pause until the end of the time interval approaches, at which point responding picks up again (e.g., Ferster & Skinner, 1957; Shimoff, Catania, & Matthews, 1981). To illustrate, when my daughter Tina was in fifth grade, she had a spelling test every Friday. She got the week’s list of spelling words each Monday and so had four evenings on which to study the list. Occasionally she began on Wednesday, but she more often waited until Thursday night to study her spelling. If we were to graph
Tina’s studying behavior, it might look something like the graph in Figure 2–7. This ‘scallop’ pattern is typical of behaviors reinforced on a fixed-interval schedule. We do not see the high rate of responding with an FI schedule that is observed for fixed- and variable-ratio schedules, nor do we see as much resistance to extinction.

Variable Interval (VI)

In a variable-interval reinforcement schedule, reinforcement is contingent on the first response emitted after a certain time interval has elapsed, but the length of that interval keeps changing from one occasion to the next. For example, the organism may be reinforced for the first response after five minutes, then the first response after eight minutes, then the first response after two minutes, and so on, with the VI schedule being identified by the average time interval.

As an illustration, you may have a friend who really enjoys talking on the telephone, so that when you try to call this individual, you often hear a busy signal. If you have an urgent need to get in touch with your friend, you may continue to dial the phone number once every few minutes until eventually your call goes through. In a similar way, students who have been told that there is always the possibility of an unannounced (“pop”) quiz in class are likely to study a little bit every night. They never know on exactly which day their studying will pay off. Your pattern of dialing your gabby friend and students’ pattern of studying for pop quizzes are typical of the response pattern observed for variable-interval schedules: a slow, steady rate of responding. The longer the average time interval until reinforcement, the slower the response rate will be (e.g., Catania & Reynolds, 1968). (We should note here that for other reasons pop quizzes are generally not recommended; see Sax, 1989, or Ormrod, 1995, for their downside.)

For both ratio and interval schedules, then, variable schedules lead to steadier response rates than fixed schedules do, probably because of the unpredictability of reinforcement after a correct response. With a variable schedule, there is always the possibility that the next correct response will pay off. Variable schedules also appear to lead to greater resistance to extinction, again possibly because of their unpredictable nature.

When using ratio or interval schedules of reinforcement to prevent the extinction of a previously acquired response, the best schedule to use depends on the rate of response desired. In most cases, a variable ratio is recommended for a high rate of responding, with a variable-interval schedule being better for a slow yet steady rate. Ideally, when continuous reinforcement is first replaced by intermittent reinforcement, the ratio should be small (e.g., 1:2 or 1:3) or the time interval short. The ratio or interval can then gradually be extended until the response continues with very little reinforcement at all.

Differential Schedules: Reinforcing Rates of Responding

When a particular rate of responding is required, a differential schedule of reinforcement is appropriate: A specific number of responses occurring within a specific length of time leads to reinforcement. There are at least three such schedules:
• Reinforcement of a differential rate of high responding
• Reinforcement of a differential rate of low responding
• Reinforcement of the nonoccurrence of the response (differential reinforcement of other behaviors)

Differential Rate of High Responding (DRH)
A DRH schedule provides reinforcement only when a specific, large number of responses (or even more responses than that specified) have occurred within a particular period of time. For example, consider Tina’s friend Margaret, the girl who persistently asked her mother for money to play a video game. Margaret may actually have been on a DRH schedule rather than a variable-ratio schedule, in that she had to ask for a quarter several times all at once to get reinforcement. With a ratio schedule, the time it takes to emit the necessary number of responses is irrelevant, but with a DRH schedule, this time period is critical. Because a DRH schedule requires many responses in a short amount of time, a high response rate is typical.

Theoretically, studying for regularly scheduled tests is really on a DRH schedule: The more studying that occurs, the greater the probability of reinforcement at exam time. However, as Klein (1987) has pointed out, too many students instead treat exams as fixed-interval schedules, thus showing the “go off now, cram later” study pattern.

Differential Rate of Low Responding (DRL)
A DRL schedule reinforces the first response after a certain time interval has elapsed in which the organism has not made the response at all. This might sound like a fixed-interval schedule, but remember that in an FI schedule, responses during the time interval, although not reinforced, are otherwise acceptable. One example of a response on a DRL schedule is trying to start a car with a flooded engine. Repeated attempts at starting it will fail; you must wait for a few minutes, then try again, before you are likely to succeed.

Students’ requests for their teacher’s assistance are an example of responses that might be most appropriately reinforced on a DRL schedule. Reinforcing students continuously when they ask for the teacher’s help might lead to a high rate of such requests and a resulting overdependence on the teacher. On the other hand, reinforcing students who ask for help only after they have been working independently for a period of time will teach them that independence with occasional questions is more acceptable.

We should note here that learning the appropriate response pattern for a DRL schedule often takes time, because it requires one not to perform a behavior that has previously been reinforced (Reynolds, 1975).

Differential Reinforcement of Other Behaviors (DRO)
In a DRO schedule, the organism is reinforced for doing anything except for making a certain response during a certain time period. In this situation, the organism must never make that particular response at all. As an example, consider the teacher who says, “I am going to write on the chalkboard the name of every student who speaks out of turn today. If your name is not on the board by three o’clock, you may have a half hour of free time.” That teacher is using a DRO schedule, because she is reinforcing children for not talking without permission.

Continuous reinforcement is clearly the most effective way of teaching a new response. Once the terminal behavior has been reached, however, the various intermittent reinforcement schedules—ratio, interval, and differential—can be beneficial both in preventing extinction (the DRO schedule excepted) and in controlling the frequency and pattern of that response.
STIMULUS CONTROL

Earlier in the section, I described Skinner’s operant conditioning as an $R \rightarrow S_{rf}$ model (where $S_{rf}$ is reinforcement) rather than the $S \rightarrow R$ model more typical of other early behaviorists. Actually, a stimulus that precedes a response can influence the likelihood that the response will occur again, although the role of this antecedent stimulus in operant conditioning is different from the role it plays in other behaviorist models such as classical conditioning.

To illustrate, here is a typical scenario in a high school class. The teacher begins to describe the evening’s homework assignment to a class of quiet and attentive students but is interrupted by a bell marking the end of the class period. Immediately the students, no longer interested in hearing their assignment, slam their notebooks shut and begin to push and shove their way toward the classroom door. These students are under stimulus control: They have learned that a particular response (leaving class) is acceptable under certain stimulus conditions (when the bell rings). A wise teacher would stand in front of the door while giving the homework assignment and not let the students leave their seats—bell or no bell. In that way, students would learn that leaving class is permissible only after a different stimulus—the teacher’s movement away from the door—has occurred.

In operant conditioning, the antecedent stimulus does not directly elicit the response as it does in classical conditioning. Instead, the stimulus sets the occasion for a response to be reinforced. When an antecedent stimulus influences the likelihood that a response will occur, we call that stimulus a discriminative stimulus, often symbolized as $S^d$, and say that the response is under stimulus control: Responses to stimuli in operant conditioning often show stimulus generalization and stimulus discrimination—phenomena similar to the generalization and discrimination observed in classical conditioning.

Stimulus Generalization

When an organism has learned to respond in a certain way in the presence of one stimulus (the $S^+$), it is likely to respond in the same way in the presence of similar stimuli; this operant conditioning phenomenon is known as stimulus generalization. Just as is true in classical conditioning, stimulus generalization is more likely to occur when stimuli are similar to the discriminative stimulus. For example, students in a kindergarten classroom (the classroom being the $S^+$) may learn such appropriate classroom behaviors as raising their hands and waiting to be called on before speaking. Such behaviors are more likely to generalize to a similar situation (such as first grade) than to a dissimilar situation (such as the family dinner table). This tendency of organisms to generalize more readily as stimuli become more similar to the discriminative stimulus is known as a generalization gradient.

Stimulus Discrimination

In classical conditioning, stimulus discrimination occurs when one stimulus (the CS+) is presented in conjunction with an unconditioned stimulus, and another stimulus (the CS−) is presented in the absence of the UCS. A similar phenomenon happens in operant conditioning: A response may be reinforced in the presence of one stimulus ($S^+$) but not in the presence of another stimulus, symbolized as $S^-$:

$$(S^+) \rightarrow S_{rf}$$
$$(S^-) \rightarrow (nothing)$$

Learning under what circumstances a response will and will not be reinforced is operant conditioning’s form of stimulus discrimination. Stimulus discrimination is essentially a process of learning that a conditioned response made in the presence of $S^+$ should not be generalized to $S^-$. 
Consider the preschooler who has learned to say ‘bee’ whenever she sees this symbol:

\[ b \]

She then sees a similar stimulus:

\[ d \]

and responds ‘bee’ once again—that is, she generalizes. (Anyone who has worked with young children who are learning their alphabet letters has probably observed that, consistent with the generalization gradient, children are much more likely to generalize the ‘bee’ response to the letter \( d \) than to less similar letters, such as \( s \) or \( y \).) If the teacher does not reinforce the child for the ‘bee’ response to the symbol \( d \), the student should eventually learn to discriminate between the letters \( b \) and \( d \).

**Stimulus Control in the Classroom**

At school, as in most other situations, different responses are desirable at different times. For example, it is perfectly appropriate, and in fact quite desirable, to talk with classmates at some times (e.g., during a classroom discussion) but not at others (e.g., during the weekly spelling test). Likewise, running may be appropriate in the gymnasium but can be dangerous in the school corridors. How can teachers encourage their students to exhibit different behaviors on different occasions? Psychologists have suggested two strategies: cueing and setting events.

**Cueing**

In the classroom, the discriminative stimuli that set the occasion for certain desired behaviors are not always obvious ones; for example, the only naturally occurring stimulus that sets the occasion for cleaning up work materials and getting ready to go to lunch might be a clock on the wall that says 11:55. Under such circumstances, teachers can provide additional discriminative stimuli that let students know how to behave—a strategy often called cueing (e.g., Good & Brophy, 1994; Krumboltz & Krumboltz, 1972; Zirpoli & Melloy, 1995).

In some situations, teachers can provide nonverbal cues to indicate desired responses. For example, during a cooperative learning activity, they might quickly flash the overhead light on and off a few times to remind students to talk quietly rather than loudly. In other situations, teachers can give verbal cues to encourage appropriate behavior. For example, an elementary teacher whose students are preparing to go to the lunchroom might cue students by saying, ‘Walk quietly and in single file.’ The teacher can then reinforce the desired behavior by allowing students to proceed only when they behave as they have been instructed. A teacher who wants to give students a subtle reminder about the necessity for accomplishing a reading assignment quickly might say, ‘After you have all finished reading about recycling on pages 69 and 70 of your geography book, I will tell you about tomorrow’s field trip to a recycling plant.’

**Setting Events**

Thus far, we have focused our discussion of stimulus control on specific stimuli (e.g., the letter \( b \) or a teacher’s cue to “walk quietly”) that encourage students to behave in particular ways. Some psychologists talk not about specific stimuli but instead about complex environmental conditions—setting events—under which certain behaviors are most likely to occur (Brown, Bryson-Brockmann, & Fox, 1986; Brown, Fox, & Brady, 1987; Kantor, 1959; Martin, Brady, & Williams, 1991; Morris, 1982; Wahler & Fox, 1981). For example, preschoolers are more likely to interact with their classmates during free play time if they have a relatively small area in which to play and if the toys available to them (balls, puppets, toy housekeeping materials) encourage group activity (Brown et al., 1987; Martin et al., 1991).
Similarly, the nature of the games that children are asked to play influences the behaviors they exhibit: Cooperative games promote increases in cooperative behavior, whereas competitive games promote increases in aggressive behavior (Bay-Hinitz, Peterson, & Quilitch, 1994). Teachers are well advised, then, to create the kinds of environments that are likely to encourage the very behaviors they want their students to exhibit.

CONTEMPORARY PERSPECTIVES ON OPERANT CONDITIONING

As we noted previously, B. F. Skinner’s ideas about operant conditioning underwent little change from 1938 until his death in 1990. The views of other behaviorists have evolved considerably over time, however. Here are some examples of how contemporary perspectives of operant conditioning differ from Skinner’s original notions:

• Behavior is better understood by looking at a larger context and longer time frame than has traditionally been the case. Early behaviorists tended to think in terms of specific S-R relationships within a relatively short time period; for example, a researcher might look at the immediate consequence of a particular response. In contrast, many behaviorists are now looking at larger and longer environmental-behavior relationships (e.g., see Herrnstein, 1990; Rachlin, 1990, 1991). The setting events that we just discussed illustrate this trend, in that they are relatively complex environmental conditions rather than specific stimuli. Some psychologists look at the choices that organisms make in situations in which several different behaviors—each leading to a different reinforcer—are possible (de Villiers, 1977; Rachlin, 1991). Others examine the conditions under which certain behaviors are likely to persist despite changes in environmental stimuli—a phenomenon sometimes known as behavioral momentum (Belfiore, Lee, Vargas, & Skinner, 1999; Mace et al., 1988; Nevin, Mandell, & Atak, 1985).

A study by Belfiore and colleagues (1997) illustrates behavioral momentum nicely. Two girls (Allison, who was 14, and Roberta, who was 15) had a history of refusing to do the academic tasks that their teachers assigned. The researchers found that they could encourage the two students to work on difficult three-digit multiplication problems if they first gave the girls some simple one-digit problems. More generally, teachers can promote behavioral momentum by assigning easy or enjoyable tasks that lead naturally into more complex and potentially frustrating ones.

• Operant conditioning involves cognition as well as behavior. Many theorists now propose that operant conditioning can best be understood when we consider nonobservable mental processes as well as observable stimuli and responses (Colwill, 1993; Rachlin, 1991; Schwartz & Reseberg, 1991; Vaughan, 1988; Wasserman, 1993). For example, they talk about an organism forming expectations as to what reinforcer is likely to follow a particular response (Colwill, 1993; Rachlin, 1991; Schwartz & Reseberg, 1991). They find that humans and nonhumans alike develop categories of stimuli to which they respond; to illustrate, pigeons can be trained to discriminate (by making different responses) between members of different categories, including cats versus flowers, cars versus trucks, pictures of Charlie Brown versus those of other Peanuts characters, and even different lengths of time (Killeen, 1991; Rachlin, 1991; Vaughan, 1988; Wasserman, 1993). And behaviorists are beginning to use such phrases as paying attention to discriminative stimuli, mentally encoding response-reinforcement relationships, and seeking information about the environment—phrases with definite cognitive overtones (Colwill, 1993; Colwill & Rescorla, 1986; Rachlin, 1991; Rescorla, 1987; Schwartz & Reseberg, 1991).

• Operant and classical conditioning, taken together, do not completely determine the behaviors that an organism will exhibit on any given occasion. B. F. Skinner was a determinist: He proposed that if we were to have complete knowledge of an organism’s past reinforcement history and present environmental circumstances, as well as knowledge of any genetic predispositions that the organism might have to behave in certain ways,
we would be able to predict the organism’s next response with total accuracy. The views of some contemporary behaviorists are not so deterministic in nature. They propose that any organism’s behavior reflects a certain degree of variability that S-R relationships cannot explain (Epstein, 1991; Rachlin, 1991). For example, if you think about it, shaping behavior—refining it through successively “fussier” reinforcement contingencies—would not be possible unless an organism varied its responses somewhat from one occasion to another. Ultimately, it is only by making changes in responses (however small those changes may be) and experiencing their consequences that new and perhaps more adaptive behaviors can emerge over time (Epstein, 1991).

Just as reinforcement increases the frequency of a response, punishment can be an effective means of decreasing a response. Early research by Thorndike (1932a, 1932b) and Skinner (1938) indicated that punishment was unlikely to reduce the behavior that it followed. But later research studies have shown that punishment can be effective in many situations. As a result, some theorists have revived the “punishment” part of Thorndike’s original law of effect, asserting that responses followed by discomfort are in fact weakened (e.g., Aronfreed, 1968; Aronfreed & Reber, 1965; Lentz, 1988; Parke, 1972, 1977; Rachlin, 1991). We should note that when behaviorists describe the effects of both reinforcement and punishment in learning and behavior, they typically use the term instrumental conditioning rather than Skinner’s operant conditioning.

We discuss punishment, including its effects and guidelines for its use, later in this section. In the meantime, we turn to the three methods for eliminating undesirable behavior within the traditional, reinforcement-based operant conditioning paradigm.

ELIMINATING UNDESIRABLE BEHAVIORS

We have talked at length about how new responses are learned, modified, and maintained through operant conditioning. But sometimes we may instead want to get rid of a behavior that has previously been acquired through reinforcement. Three methods of reducing and eliminating misbehavior derived from Skinner’s model of operant conditioning are extinction, differential reinforcement of other behaviors, and reinforcement of incompatible behaviors.

Extinguishing Responses

A psychologist was once consulted about Jimmy, a child who had been hospitalized for an extended period. Nurses in the children’s ward were very concerned because Jimmy kept banging his head on the side of his crib; whenever they heard him doing so, they would rush to his room and stop the behavior, thereby inadvertently reinforcing and maintaining the head-banging behavior. The psychologist successfully eliminated Jimmy’s head-banging through a process of extinction: A protective helmet was strapped on Jimmy’s head to prevent injury, and the nurses were instructed to ignore Jimmy during his head-banging episodes. At the same time, because Jimmy clearly craved attention, the nurses did attend to him on other occasions.

Extinction—making sure that a particular response no longer leads to reinforcement—is sometimes an effective means of eliminating inappropriate behavior. Students who engage in disruptive behavior in class may stop if such behavior no longer results in the teacher attention they seek (i.e., if the teacher ignores them). Cheating on classroom assignments may soon disappear if students never receive credit for the scores they obtain on those assignments. We don’t necessarily want to eliminate the particular reinforcers (e.g., attention, class credit) that have been operating in such circumstances, but we need to make sure that those reinforcers are not contingent on the responses we are trying to eliminate (e.g., Fischer, Iwata, & Mazaleski, 1997).
Unfortunately, extinction is often not the most reliable method of eliminating unwanted behavior, for several reasons. First, it is not always possible to identify the specific consequence that is actually reinforcing a response; for example, children who, like Jimmy, engage in head-banging behavior do so for different reasons—perhaps to gain adult attention, to escape from academic tasks (a form of negative reinforcement), or to provide self-stimulation (Iwata, Pace, Cowdery, & Miltenberger, 1994). Second, there may often be several reinforcers involved in maintaining a response, including some that are difficult to remove; for example, although a teacher may be able to ignore the comments of a class clown, other students in the class may continue to reinforce those comments. Third, extinguished behaviors sometimes show spontaneous recovery: A response that has been extinguished one day may pop up again at a later date, perhaps in a different context (Alberto & Troutman, 1990; Skinner, 1953). And fourth, some responses may be particularly resistant to extinction because they have previously been reinforced on an intermittent schedule. When responses cannot be extinguished for any of these reasons, other methods may be more useful.

Reinforcing Other Behaviors

As noted earlier, the differential reinforcement of other behaviors—a DRO reinforcement schedule—is a procedure whereby an organism is reinforced for not exhibiting a particular behavior during a specified time interval. For example, when a teacher praises a student who manages to get through an entire recess without fighting with any of his classmates, that teacher is using a DRO schedule. The differential reinforcement of other behaviors tends to be a more effective and long-lasting technique than extinction (Uhl, 1973; Uhl & Garcia, 1969; Zeiler, 1971) and has been shown to be effective in reducing a variety of inappropriate classroom behaviors (Parrish, Cataldo, Kolko, Neef, & Egel, 1986; Pinkston, Reese, LeBlanc, & Bar, 1975; Repp & Deitz, 1974; Repp, Barton, & Brulle, 1983).

Reinforcing Incompatible Behaviors

We have previously encountered the use of incompatible responses in the discussion of breaking habits and the discussion of counterconditioning. Within the operant conditioning model, the notion of incompatibility is equally useful. The first step is to identify a response that is incompatible with the undesirable response—a response that cannot be performed at the same time as the undesirable response. That incompatible behavior is then reinforced. For example, a child's inappropriate out-of-seat behavior may be reduced by reinforcing the child whenever she is sitting down. Similarly, an aggressive student can be reinforced whenever he is interacting in a prosocial manner with his classmates. Krumboltz and Krumboltz (1972) have described how reinforcing an incompatible behavior was effective in handling the chronic litterbug at a junior high school: The student was put in charge of his school's antilitter campaign and given considerable recognition and praise for his efforts.

The reinforcement of incompatible behaviors sounds similar to the DRO schedule, but a subtle difference exists between the two methods. The DRO schedule involves the reinforcement of nonoccurrence of a particular response. Reinforcing incompatible behaviors involves the reinforcement of a specific, opposite response. Like a DRO schedule, it is typically more effective than extinction in eliminating undesirable behaviors (Lenton, 1988; Zirpoli & Melloy, 1993).

When none of the techniques I've just listed—extinction, differential reinforcement of other behaviors, or reinforcement of incompatible behaviors—proves effective, punishment may be a viable alternative for eliminating an inappropriate behavior. Later we will consider some guidelines for using punishment effectively.
WHEN REINFORCEMENT DOESN'T WORK

The basic principle of operant conditioning—that a response increases in frequency when it is followed by reinforcement—has been used successfully in many different situations to change a wide variety of behaviors. When reinforcement doesn't work, the source of difficulty can often be traced to one of four circumstances: (1) the “reinforcer” is not reinforcing; (2) reinforcement isn't consistent; (3) the individual loses too much, or gains too little, by changing a behavior; or (4) too much is expected too soon.

The “Reinforcer” Doesn’t Reinforce

A first-grade teacher once consulted me about one of her students, a boy so disruptive that he was only able to spend a half day in the classroom. In an effort to modify the disruptive behavior, the teacher had attached to the boy’s desk a large sheet of heavy cardboard that was cut and painted to look like a clown, with a small red lightbulb for a nose. When the boy exhibited appropriate classroom behaviors, such as sitting quietly or attending to an assigned task, the teacher would push a button on a remote control that lit up the red nose. “I don’t understand why his behavior isn’t changing,” she told me. “Maybe this clown isn’t reinforcing to the boy,” I suggested. “Nonsense!” exclaimed the teacher. “The clown has always worked with other children!”

One of the most common mistakes that teachers make in using operant conditioning techniques is to assume that certain consequences will be reinforcing for all students. Not everyone will work for the same reinforcers; a consequence that increases desired behaviors for one child may not increase such behaviors for another. For example, although most students find their teacher’s praise reinforcing, some students do not (e.g., Pfiffner, Rosén, & O’Leary, 1985). Some students may be afraid of being labeled “teacher’s pet,” especially if they value the friendship of peers who shun high achievers. Many Native American students, although they appreciate praise for group achievements, may feel uncomfortable when their own individual efforts are singled out as being noteworthy (Grant & Gomez, 1996).

How can teachers determine what events will be reinforcing for different students? One way is to watch the students to see what kinds of consequences seem to affect their behavior. Another approach is to ask the students’ parents, or even the students themselves. The one thing not to do is guess.

We should note here that any single reinforcer will not necessarily maintain its reinforcing value indefinitely, especially if it occurs with high frequency (Viken & McFall, 1994). For example, as much as you probably enjoy good food, you can only eat so much, and as much as you enjoy the praise of people you respect, constant praise gets tiresome after a while. It’s certainly possible to get too much of a good thing.

Reinforcement Is Inconsistent

Sometimes it is inconvenient to reinforce a behavior every time it occurs. But remember, continuous reinforcement brings about more rapid behavior change than intermittent reinforcement. If a student’s behavior has been particularly disruptive and time-consuming, a little extra time devoted now to the continuous reinforcement of appropriate behaviors, inconvenient as that may occasionally be, will probably save time over the long run.

Change Isn’t Worthwhile

An individual may lose too much, or else gain too little, by changing a behavior. Consider the teenager who shies away from teacher praise because his peer group does not approve of academic achievement. It may be that teacher praise is a reinforcer to this student, but he risks losing his status in the group if he is praised too frequently or profusely. Praise given
privately, out of the earshot of peers, will probably be much more reinforcing than public praise in this case.

Sometimes the desired behavior simply requires too much effort to be worth the payoff (e.g., Friman & Poling, 1995). For example, people in the workplace often recycle office paper when recycling boxes are placed on their desks; they are much less likely to do so when they have to walk across the room to find such boxes (Brothers, Krantz, & McElrath, 1994). And consider the college student who estimates that she will have to study at least 20 hours a week to get an A in a history class. Although the A may be an effective reinforcer, it may not be worth the amount of time she will have to spend to earn it.

Consciously or otherwise, people may sometimes engage in a cost-benefit analysis when looking at the consequences of different behaviors (e.g., Eccles & Wigfield, 1985; Feather, 1982). Although they may have learned that a certain response will be reinforced, they will nevertheless not respond in that way if they have too much to lose, or too little to gain, by doing so. For people to respond positively to reinforcement, it must be worth their while.

**Shaping Proceeds Too Rapidly**

Reinforcement is ineffective when too much is expected too soon. In many situations, establishing a desirable behavior requires a process of shaping that behavior. Remember that shaping involves the reinforcement of a series of responses that more and more closely approximate the terminal behavior. Each response should be well learned before reinforcement proceeds to a closer approximation. If an attempt at shaping moves too quickly, such that each response is not well established before a more sophisticated one is expected, the reinforcement program will be ineffective in bringing about behavior change.

To illustrate, let's say that Ms. Garcia, a third-grade teacher, wants to reinforce Jack, an especially hyperactive student, for sitting quietly in his seat; her goal (the terminal behavior) is for him to sit quietly for 20 minutes. On the first morning of the intervention program, Jack sits quietly for one minute, and so Ms. Garcia reinforces him. She probably does not want to move on to a two-minute criterion just because he has met the one-minute criterion once. Instead, she should continue reinforcing Jack for one-minute “sits” until it is clear, from the frequency of his sitting behavior, that she can begin to expect that behavior for a longer period of time.
ineffective, it may also encourage students to engage in behaviors that allow them to escape school tasks or avoid them altogether.

Skinner urged educators to focus on reinforcing student successes rather than on punishing student failures. He proposed a "technology of teaching" whereby instruction is individualized, complex verbal behaviors are gradually shaped, reinforcement for appropriate responses is consistent and immediate, and learned behaviors are maintained through intermittent reinforcement schedules. Skinner's suggestions for how operant conditioning might be successfully applied to classroom situations, and the suggestions of other psychologists and educators as well, will be discussed in detail shortly.

**SUMMARY**

The basic principle of operant conditioning is that responses followed by reinforcement increase in frequency. For operant conditioning to occur, a reinforcer must follow immediately after a response and also be contingent on that response. Operant conditioning is different from classical conditioning in at least three ways: (1) it occurs as a result of a response being followed by a reinforcing stimulus rather than as a result of two stimuli being paired, (2) it involves voluntary rather than involuntary responses, and (3) it is better described as an R → S relationship than as an S → R relationship.

The free operant level, or baseline, of a response is its frequency in the absence of reinforcement; the terminal behavior is the form and frequency of the desired response at the end of a reinforcement program. Even when a response-reinforcer sequence occurs by coincidence rather than by design, an increase in the frequency of that response is observed (superstitious behavior). A response that has previously been reinforced but is no longer being reinforced tends to decrease in frequency to its baseline rate (extinction). Complex behaviors can be taught by reinforcing successive approximations to the desired terminal behavior (shaping) or by reinforcing an increasingly longer series of responses (chaining).

Reinforcement takes a variety of forms. A primary reinforcer is one that satisfies a biological need; a secondary reinforcer is one that becomes reinforcing through repeated association with another reinforcer. Whereas positive reinforcement involves the presentation of a (presumably pleasant) stimulus, negative reinforcement involves the removal of a (presumably aversive) stimulus, because negative reinforcement increases behavior just as positive reinforcement does; it is not a form of punishment. A reinforcer is not always a material object; for instance, it can also be a social event, a favorite activity, an intrinsic feeling of satisfaction, or positive feedback.

Timing, magnitude, and consistency of reinforcement affect the rate at which new behaviors are learned. Different schedules of reinforcement influence the frequency with which responses occur, as well as the rates at which those responses are acquired and extinguished.

Antecedent stimuli also affect the occurrence of a response. For example, when an organism has learned to respond in a certain way in the presence of one stimulus, it is likely to respond in the same way in the presence of similar stimuli (stimulus generalization). However, if a particular response has been reinforced in the presence of one stimulus but not in the presence of another, the organism will exhibit the response only when the former stimulus is presented (stimulus discrimination). Teachers can use a variety of antecedent stimuli, perhaps taking the form of cues or setting events, that encourage appropriate classroom behaviors.

Contemporary perspectives of operant conditioning differ somewhat from Skinner's original notions. For example, some theorists propose that behavior is better understood by looking beyond specific S-R relationships to a larger context and longer time frame. In addition, some current explanations of why operant conditioning takes place include a discussion of the cognitive factors that underlie conditioning. And many theorists now believe that behavior may never be totally predictable—that human and nonhuman behavior is somewhat variable even when reinforcement histories and stimulus conditions remain constant.
In addition to punishment (which, according to many contemporary behaviorists, does lead to a response decrease), three techniques based on a traditional, reinforcement-based model of operant conditioning—extinction, the differential reinforcement of other behaviors, and the reinforcement of incompatible behaviors—serve as viable means of eliminating undesirable behaviors. B.F. Skinner contended that, in classroom situations, appropriate behaviors are usually reinforced inconsistently and undesirable behaviors are often unintentionally reinforced.

NOTES

1 When teaching the chicken to play baseball, the trainer probably used backward chaining, starting with the final response in the sequence and then adding, one by one, the responses that needed to precede it. In other situations, trainers or teachers might use forward chaining, reinforcing the first response in the sequence and then adding subsequent responses to the sequence that is reinforced. Research yields mixed results regarding the relative effectiveness of these two approaches with human beings (Zirpoli & Melloy, 1993).

2 Don’t let the word negative in negative reinforcement lead you astray here. It is not a value judgment but simply refers to the fact that something is being taken away from the situation.

3 Note that, although behaving in a disruptive fashion is a response that Marvin makes, in this situation it serves as a stimulus that Ms. Jones wants to eliminate.

4 We should note here that praise has a potential downside, depending on the specific message that it contains and the context in which it is given.

5 If you read any of Skinner’s writings on this topic, you should note that he used the symbol $S^+$ instead of $S$.

6 Note that Skinner used the symbol $S^-$ instead of $S$.

7 Some theorists instead use the term prompting.
Applications of Operant Conditioning

Instructional Objectives
  Behavioral Objectives
  The Current Perspective on Instructional Objectives
  Formulating Different Levels of Objectives
  Usefulness and Effectiveness of Objectives
Programmed Instruction and Computer-Assisted Instruction
  Effectiveness of PI and CAI
Mastery Learning
  Keller’s Personalized System of Instruction (PSI)
  Effectiveness of Mastery Learning and PSI
Contingency Contracts
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Applied Behavior Analysis
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  Using Applied Behavior Analysis with Large Groups
  Adding a Cognitive Component to ABA
  Effectiveness of ABA
Criticisms of Using Reinforcement in the Classroom
  Bogus Complaints
  Genuine Concerns
  When Operant Conditioning Techniques Are Most Appropriate
Summary

Over the past 40 years, operant conditioning has influenced educational practice significantly. At least five educational innovations can be attributed either directly or indirectly to operant conditioning principles: (1) instructional objectives; (2) programmed instruction and its offspring, computer-assisted instruction; (3) mastery learning; (4) contingency contracts; and (5) applied behavior analysis. In this section we will look at the basic components of these innovations and consider empirical evidence concerning their effectiveness. We will then address frequently expressed concerns regarding the use of reinforcement in the classroom.

Taken from *Human Learning*, Third Edition by Ormrod.
INSTRUCTIONAL OBJECTIVES

In its 1947 report, the President’s Commission on Higher Education described the primary goal of the U.S. educational system as ‘the full, rounded, and continuing development of the person’ (cited in Dyer, 1967, p. 14). At first glance, this might seem to be a worthwhile and appropriate goal for education, but on closer inspection, the statement provides very little specific information regarding what an educated person should be like. The President’s Commission report is a good example of ‘word magic’. It sounds nice, but we eventually realize that we don’t have a clue as to what the words really mean (Dyer, 1967). When we don’t know exactly what our educational objectives are, we don’t know what or how to teach, nor do we know whether instruction is effectively accomplishing its goals.

As we noted in the preceding section, a standard practice in using operant conditioning is to specify the terminal behavior in precise, observable terms before conditioning begins, thereby allowing us to develop appropriate methods of shaping the desired behavior and of determining when that behavior has been acquired. This principle of a priori specification of the terminal behavior in observable, measurable terms has been applied to classroom instruction in the form of instructional objectives, and often more specifically in the form of behavioral objectives.

Behavioral Objectives

Ideally, a behavioral objective has three components (Mager, 1962, 1984; Schloss & Smith, 1994). First, the outcome is stated in terms of an observable and measurable behavior.

Consider this objective: "The student will be aware of current events." A student’s ‘awareness’ is not easily observable. The same objective can be stated in terms of one or more specific behaviors that a student should exhibit; consider this one as an example: "The student will describe the major cause of political unrest in South Africa." Some verbs (e.g., understand, appreciate, know, be aware of, and remember) tell us little, if anything, about what students should actually be able to do, but others (e.g., write, compute, list, describe, and select) clearly communicate observable responses. We can probably conceptualize almost any objective in behavioral terms if we think about the specific things people would have to do to convince someone that they had met the objective (Mager, 1972).

Second, a behavioral objective specifies the conditions under which the behavior should be exhibited. Sometimes we expect desired behaviors to occur in specific situations (stimulus conditions). For example, one of my objectives for my graduate course in educational assessment is as follows: "The student will correctly compute test-retest reliability." I do not expect students to memorize the formula for calculating test-retest reliability, however. Hence, there is a condition under which I expect the behavior to occur: "Given the formula for a correlation coefficient, the student will correctly compute test-retest reliability."

Finally, the objective includes a criterion for judging the acceptable performance of the behavior. Many behaviors are not strictly right or wrong; instead, they vary on a continuum of relative ‘rightness’ and ‘wrongness.’ In cases where right and wrong behaviors are not obvious, a behavioral objective should specify the criterion for acceptable performance, perhaps in terms of a certain percentage of correct answers, a certain time limit, or...
the degree of acceptable deviation from the correct response (Mager, 1962, 1984). Here are some examples to illustrate this point:

- On weekly written spelling tests, the student will correctly spell at least 85% of the year’s 500 spelling words.
- Given a sheet of 100 addition problems involving the addition of two single-digit numbers, including all possible combinations of the digits 0 through 9, the student will correctly write the answers to these problems within five minutes.
- Given the formula for a correlation coefficient, the student will correctly compute test-retest reliability, with differences from a computer-calculated coefficient being attributable to rounding-off errors.

The Current Perspective on Instructional Objectives

Behavioral objectives have frequently been criticized for focusing on concrete, picayune details rather than on more central, but probably more abstract, educational goals. For example, many lists of behavioral objectives emphasize behaviors that depend on the rote memorization of facts rather than on behaviors that reflect more complex and sophisticated learning (Trachtenberg, 1974); in other words, they focus on **lower-level skills** rather than **higher-level skills**. Such lower-level objectives may be prevalent simply because they are the easiest ones to conceptualize and write.

School personnel have many goals in mind for each classroom in any given year; these goals typically encompass both lower-level and higher-level skills. Writing behavioral objectives that cover each and every goal can sometimes become a burdensome, if not impossible, task. As a result, many educators have proposed that a smaller number of general, nonbehavioral objectives provide an acceptable alternative (e.g., Dressel, 1977; Gronlund, 1995; Popham, 1995; Posner & Rudnitsky, 1986). But in such situations, it is helpful to list examples of behaviors that reflect each abstract objective. To illustrate, imagine that we want high school students to understand, evaluate, and critique the things that they read—an objective that certainly involves higher-level thinking skills. We might list behavioral manifestations of critical reading such as the following:

1. Distinguishing between main ideas and supporting details
2. Distinguishing between facts and opinions
3. Distinguishing between facts and inferences
4. Identifying cause-effect relations
5. Identifying errors in reasoning
6. Distinguishing between valid and invalid conclusions
7. Identifying assumptions underlying conclusions (Adapted from Gronlund, 1995, p. 52)

This is hardly an exhaustive list of what critical reading entails, but it gives us an idea of the terminal behaviors we want to see.

Formulating Different Levels of Objectives

Sometimes objectives that reflect basic knowledge and skills are appropriate. But in many circumstances, objectives reflecting relatively sophisticated levels of learning are desired, especially as students get older (e.g., see Cole, 1990). In such situations, **taxonomies** of objectives—the various behaviors we might want to see students demonstrate, often listed in order of increasing complexity—are helpful (e.g., see Bloom, Englehart, Furst, Hill, & Krathwohl, 1956; Harrow, 1972; Krathwohl, Bloom, & Masia, 1964; Stiggins, 1994). As an example, Bloom’s Taxonomy of Educational Objectives (Bloom et al., 1956) describes six general
levels of knowing and using information—that is, six possible objectives in the cognitive domain. An overview of this taxonomy is presented in Figure 2–8.

1. **Knowledge**: rote memorizing of information in a basically word-for-word fashion; for example, repeating definitions of terms or remembering lists of items.
2. **Comprehension**: translating information into one’s own words; for example, rewording a definition or paraphrasing a rule.
3. **Application**: using information in a new situation; for example, applying mathematical principles to the solution of word problems or applying psychological theories of learning to educational practice.
4. **Analysis**: breaking information down into its constituent parts; for example, discovering the assumptions underlying a philosophical essay or identifying fallacies in a logical argument.
5. **Synthesis**: constructing something new by integrating several pieces of information; for example, developing a theory or presenting a logical defense for a particular point of view.
6. **Evaluation**: placing a value judgment on data; for example, critiquing a theory or determining the appropriateness of conclusions drawn from a research study.

**Figure 2–8**
Bloom’s Taxonomy of Educational Objectives (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956).

Bloom and his colleagues originally presented the six levels as a hierarchy, with each one depending on those preceding it in the list. Although the hierarchical nature of Bloom’s cognitive domain is in doubt (Furst, 1981; Krathwohl, 1994; Seddon, 1978), the taxonomy nevertheless provides a useful reminder that instructional objectives should often encompass higher-level cognitive skills as well as the knowledge of simple, discrete facts (Gronlund, 1995; Hastings, 1977; Popham, 1988).

**Usefulness and Effectiveness of Objectives**

From a teacher’s perspective, objectives serve several useful functions (Gronlund, 1995; Mager, 1962, 1984; Niggens, 1994). First, specification of a lesson’s objectives in precise terms helps a teacher choose the most effective method of teaching that lesson. For example, when teaching a unit on basic addition, a teacher might use flash cards if the objective is knowledge of number facts but might instead use word problems if the objective is the application of those number facts. A second advantage is that objectives, especially when described in behavioral terms, are easily communicated from one teacher to another. For example, although teachers may differ in their conception of what “application of addition principles” means, they will be likely to interpret “correct solution of addition word problems” similarly. Finally, objectives facilitate the evaluation of both the student and the instructional program: Student accomplishment and program effectiveness can be evaluated on the basis of whether manifestations of the desired behaviors are observed. From a student’s perspective, instructional objectives have an additional advantage: Students who are told what they should be able to do at the conclusion of an instructional unit have tangible goals to strive for and are better able to judge correctly how successfully they have learned (Gronlund, 1995; McAshan, 1979; Niggens, 1994).

Because instructional objectives often specify the outcomes of instruction so explicitly, students usually view them favorably. However, research studies investigating the effectiveness of objectives for improving academic performance have yielded mixed results (Melton, 1978). Objectives tend to focus teachers’ and students’ attention toward certain information
and skills (those things that are included in the objectives) and away from other subject mat-
er (e.g., Slavin, 1990b). If the stated objectives encompass everything that students should
learn, the use of objectives in the classroom will enhance learning. But if the objectives
include only a portion of what the teacher deems to be important, while excluding other,
equally important, material, some critical information and skills are not as likely to be learned
as completely as they might otherwise be.

PROGRAMMED INSTRUCTION AND
COMPUTER-ASSISTED INSTRUCTION

From the perspective of operant conditioning, reinforcement must occur immediately after a
response to have a significant impact on that behavior. Yet many reinforcers of classroom
learning are delayed by hours, days, or, in the case of a high school diploma or college degree,
even years. To provide a means by which responses can be reinforced immediately, Skinner
(1954) developed a technique most frequently known as programmed instruction, or PI.
In its earliest form, programmed instruction involved an adaptation of Pressey’s (1926, 1927) teaching machine. This ‘machine’ was a box enclosing a long roll of printed material
that a student could advance past a display window, thereby viewing small portions of infor-
mation successively and systematically. Since the teaching machine, programmed instruction
has evolved into programmed textbooks and, more recently, computer-assisted instruction.
Regardless of the form it takes, programmed instruction consists of several standard fea-
tures. First, the material to be learned is presented through a series of discrete segments, or
frames. The first frame presents a small piece of information and poses a question about it.
The student responds to the question, then turns to the next frame; that frame provides
the correct answer to the question posed in the previous frame, presents more information,
and asks another question. The student continues through the frames, encountering new
information, responding to questions, and checking his or her answers against those pro-
vided by the program.

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**FRAME 1**

An **objective** is a goal for an instructional unit. (information)

Another name for the goal of an instructional unit is an ___________ . (question)

**FRAME 2**

A behavioral **objective** is an objective that specifies the goals of an instructional
unit in terms of the **behaviors** that the student should be able to demonstrate at the completion of the unit.

An objective that specifies instructional goals in terms of behaviors that the student can demonstrate is called a ___________ objective.
To illustrate the PI process, I have developed some possible frames for a unit on writing behavioral objectives, as follows:

Intrinsic to programmed instruction are several concepts and principles based on operant conditioning, including the following:

1. **Terminal behavior.** The goals of instruction are specified before the instructional program is developed in terms of the terminal behaviors (the behavioral objectives) to be demonstrated upon completion of instruction.
2. **Active responding.** The student is required to make a response in each frame.
3. **Shaping.** Instruction begins with information that the student already knows. The new information to be learned is broken into tiny pieces, and instruction proceeds through a gradual presentation of increasingly more difficult pieces. As the successive pieces are presented and questions of increasing difficulty are answered, the terminal behavior is gradually shaped.
4. **Immediate reinforcement.** Because instruction involves a gradual shaping process, the probability is quite high that a student will give correct answers to the questions asked. Each correct answer is reinforced immediately in the form of feedback that it is correct.
5. **Individual differences in learning rate.** Programmed instruction is self-paced, allowing students to progress through an instructional unit at their own rate of speed.

The earliest form of programmed instruction was the **linear program:** All students proceeded through exactly the same sequence of frames in exactly the same order. A more recent trend is to use a **branching program,** a technique introduced by Norman Crowder (Crowder & Martin, 1961). Branching programs typically progress in larger steps than linear programs (each frame presents more information), so that error rates in responding are somewhat higher. A student who responds incorrectly is directed to one or more "remedial" frames for further practice on that part of the lesson before being allowed to continue with new information. To illustrate, let's resume our lesson on behavioral objectives (beginning where we left off, with frame 4) but now using a branching format.

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**FRAME 3**

*A behavioral objective should describe the desired behavior in such a way that the behavior is both observable and measurable.*

A behavioral objective is an instructional goal in which an observable and __________ behavior is described.

---

**FRAME 4**

*The student will write the correct answer to the problem "2 + 2 =?" In this objective, the word write describes an observable behavior.*

Which one of the following verbs is an example of an observable behavior: think, appreciate, write, or learn? ____________
The student will write the correct answer to the problem "2 \div 2 = ?". In this objective, the word write describes an observable behavior.

Which one of the following verbs is an example of an observable behavior: think, appreciate, write, or learn? ____________

If you answered think, appreciate, or learn, go to frame 6. If you answered write, go to frame 7.

The verbs think, appreciate, and learn all describe internal mental events; they are not observable behaviors. Only the verb write describes an observable behavior. Return to frame 4 and try again.

Yes, the verb write is the only one of the four that describes an observable behavior. The other verbs—think, appreciate, and learn—cannot be directly observed.

The student will learn the alphabet. This is not a behavioral objective because the verb learn does not describe an observable behavior.

The above objective could be changed into a behavioral objective by replacing the verb learn with which one of the following: remember, memorize, or recite? ____________

If you answered remember or memorize, go to frame 9. If you answered recite, go to frame 13.
The major advantage of a branching program is that it provides remedial instructional frames only for students who have difficulty with a particular concept; other students can move on to new information without having to spend time on practice they don’t need. Unfortunately, however, a branching program can be cumbersome, at least in its textbook form. Students are referred to different frames and often to different pages for each response they make, so progression through the program is rarely smooth. Fortunately, this drawback of the branching program has been virtually eliminated by the advent of computer-assisted instruction.

Computer-assisted instruction, or CAI, is programmed instruction presented by means of a computer. It has several advantages not characteristic of paper-pencil forms of programmed instruction. First, branching programs can be used without having to instruct students to proceed to one frame or another; the computer automatically presents the appropriate frame for any response the student has given. Second, because of the graphics capabilities of computers (e.g., complex moving visual displays can be included in lessons), CAI can present information in a way that traditional programmed instruction cannot. A good example is the use of simulation programs, programs that give students practice in performing skilled operations (such as flying an airplane) without the risk or expense that
would be associated with performing those operations in real-life situations. Third, the computer can record and maintain ongoing data for each student, including information such as how far a student has progressed in the program, how often he or she is right and wrong, how quickly he or she responds, and so on. With such data, a teacher can monitor each student's progress through the program and identify students who are having particular difficulty with the material. And, finally, a computer can be used to provide instruction when flesh-and-blood teachers are not available; for example, CAI is often used to deliver college instruction in rural areas far removed from university settings. (We should note here that, as cognitivism increasingly dominates theories of human learning, computer instruction is no longer restricted to the traditional, behaviorism-based CAI approach; hence, you may sometimes see reference to such terms as computer-assisted learning [CAL] or computer-based instruction [CBI] rather than CAI.)

Effectiveness of PI and CAI

Most research indicates that traditional (i.e., noncomputer-based) programmed instruction is no more effective than traditional instructional methods (Feldhusen, 1963; Lange, 1972; Reese & Parnes, 1970; Schramm, 1964). In contrast, CAI is frequently shown to be superior to traditional instruction in terms of both increased academic achievement and improved student attitudes toward schoolwork (Hativa & Shorer, 1989; Kulik, Kulik, and Cohen, 1980; Lepper & Gurtner, 1989; Tudor, 1995).

A cautionary note regarding the use of PI and CAI is in order, however. Some programmed instruction packages may be poorly conceived (Bell-Gredler, 1986; O'Leary & O'Leary, 1972); for example, they may not always adequately incorporate such principles as active responding, immediate reinforcement of responses, or gradual shaping of the terminal behavior. Programmed instruction is less likely to be effective when such principles of operant conditioning are violated.

MASTERY LEARNING

Inherent in the behaviorist perspective, and especially in the operant conditioning model, is the belief that, given appropriate environmental conditions (e.g., consistent reinforcement of desirable behaviors and gradual shaping of responses over time), people are capable of acquiring many complex behaviors. As an example of such optimism, you may remember John Watson's famous quote presented earlier: “Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select...”

The optimism of behaviorism is reflected in mastery learning—an approach to instruction in which students must learn one lesson well (i.e., master the content) before proceeding to the next lesson. Underlying this approach is the assumption that most students can learn school subject matter if they are given sufficient time and instruction to do so.

Mastery learning is based, in part, on the operant conditioning concept of shaping: At first, a relatively simple response is reinforced until it is emitted frequently (i.e., until it is mastered); then a slightly more difficult response is reinforced, and so on until eventually the desired terminal behavior is acquired. Consistent with shaping, mastery learning usually includes the following components:

1. **Small, discrete units.** Course content is broken up into a number of separate units or lessons, with each unit covering a small amount of material.
2. **A logical sequence.** Units are sequenced such that basic concepts and procedures—those that provide the foundation for later units—are learned first. More complex concepts and procedures, including those that build on basic units, are learned later. For example, a unit in which students learn what a fraction is...
would obviously come before a unit in which they learn how to add two fractions together. The process through which the component parts of course content are identified and sequenced, going from simpler to more complex, is called task analysis.

3. Demonstration of mastery at the completion of each unit. Before “graduating” from one unit to the next, students must show that they have mastered the current unit—for example, by taking a test on the content of that unit.

4. A concrete, observable criterion for mastery of each unit. Mastery of a topic is defined in specific, concrete terms. For example, to “pass” a unit on adding fractions with the same denominator, students might have to answer at least 90% of test items correctly.

5. Additional “remedial” activities for students needing extra help or practice. Students do not always demonstrate mastery on the first try. Additional support and resources—perhaps alternative approaches to instruction, different materials, workbooks, study groups, and individual tutoring—are provided for students who need them (e.g., Guskey, 1985).

Mastery learning gained prominence during the 1960s, and many educators still advocate it in one form or another (Block, 1980; Bloom, 1968, 1974, 1976, 1981, 1984; Boschee & Baron, 1993; Carroll, 1963; 1989; Guskey, 1985, 1994; Hunter, 1982; Keller, 1968; Lee & Pruitt, 1984). A particular form of mastery learning—Fred Keller’s personalized system of instruction—has been used extensively at the college level. Let’s take a closer look at what this approach entails.

Keller’s Personalized System of Instruction (PSI)

As Michael (1974) has pointed out, traditional college instruction has definite weaknesses when viewed from the perspective of operant conditioning principles. For example, students may not learn what grades they’ve earned for their work until days or weeks after they’ve submitted the work; hence, achievement is not immediately reinforced. Furthermore, students must frequently proceed to advanced material before they have mastered the more basic information necessary to understand it.

To remedy such weaknesses of college instruction, Keller (1968, 1974) developed the personalized system of instruction (also known as PSI, or the Keller Plan) as an alternative approach to teaching college students. In addition to the discrete modules, logical sequence, and frequent measures of mastery characteristic of other mastery learning approaches, PSI encompasses the following features:

1. Emphasis on individual study. Most learning occurs through students’ independent study of such written materials as textbooks and study guides. One-on-one tutoring provides additional assistance when necessary.

2. Unit exams. An examination on each module assesses students’ mastery of the material. Students receive immediate feedback about how well they have performed on unit exams.

3. Self-pacing. Students report to class to take exams when they are ready to do so; in this sense, learning is self-paced. Some students proceed through the course very quickly, and others progress more slowly. (Note that self-pacing is sometimes, but not always, a component of other mastery approaches as well.)

4. Supplementary instructional techniques. Traditional group instructional methods (e.g., lectures, demonstrations, and discussions) are occasionally provided as supplementary presentations of the same material that also appears in the textbook or other assigned readings. These group classes are optional but serve to motivate and stimulate students.

5. Use of proctors. Proctors, usually more advanced students, administer and score exams and tutor students on topics with which they are having difficulty.
The teacher of a PSI course plays a different role from that of someone using a more conventional approach to instruction. The PSI teacher is less of a lecturer and more of a curriculum developer, exam writer, proctor coordinator, and record keeper. Rather than leading students through course content, the PSI teacher instead provides an elaborate system whereby students, with the assistance of study guides and tutors, find their own way through.

Effectiveness of Mastery Learning and PSI

Several reviews of research findings (Arlin, 1984; Block & Burns, 1976; Kulik, Kulik, & Bangert-Drowns, 1990; Kulik, Kulik, & Cohen, 1979; Shuell, 1996) indicate that mastery learning (including PSI) facilitates student learning and often leads to higher achievement than more traditional approaches (although note that Slavin [1987, 1990b] found no substantial differences). Furthermore, students in mastery learning programs often retain the things they have learned for longer periods of time (DuNann & Weber, 1976; Kulik, et al., 1979); to illustrate, in one study, college students in mastery-based psychology classes remembered 75 to 85% of the material after four months and 70 to 80% after 11 months (Semb, Ellis, & Araujo, 1993). And PSI, at least, facilitates better study habits: Although PSI students don’t appear to study more than other students, they study regularly rather than procrastinating and cramming the way students in traditional courses often do (Born & Davis, 1974; Kulik et al., 1979). Low-achieving students in particular seem to benefit from a mastery learning approach (DuNann & Weber, 1976, Kulik et al., 1990).

Mastery learning and PSI are not without their problems, however. In many cases, students who learn quickly receive less instruction than their classmates, raising a concern about possibly inequitable treatment of these students (Arlin, 1984). Furthermore, for logistical reasons, fast-learning students must sometimes wait until their slower classmates have also mastered the material before they can proceed to the next unit; as a result, they learn less than they might otherwise (Arlin, 1984). Yet when all students are allowed to work at their own pace, teachers must assist and keep track of perhaps 25 or 30 students working on different tasks and succeeding at different rates; hence, they may do more “managing” (e.g., distributing materials and grading tests) than actual teaching (Berliner, 1989; Prawat, 1992).

Additional weaknesses have been noted for PSI in particular. One difficulty lies in the required mastery of material; some students are unable to meet the criterion for passing exams, despite repeated testings (Sussman, 1981). A second weakness is the lack of interaction among students—interaction that many students see as beneficial to their learning (Gasper, 1980). A third problem is related to the self-paced nature of a PSI course, which is sometimes compromised if university policy requires that students complete a course within one quarter or semester (Sussman, 1981). Poorly motivated students are likely to procrastinate until finally they must withdraw from the course (Sussman, 1981; Swenson, 1980), although withdrawal rates from PSI courses do not appear to be appreciably higher than withdrawal rates from traditional courses (Kulik et al., 1979, 1990). Several techniques have been shown to reduce procrastination and withdrawal from PSI, among them setting target dates for the completion of different modules (Reiser & Sulli- van, 1977), giving bonus points for early completion of modules (Bufford, 1976), and eliminating the necessity for completing the course within one college term (Sussman, 1981).

Mastery learning is probably most appropriately used when a teacher’s main objective is for students to learn specific skills or a specified body of information. In such situations, the immediate feedback and emphasis on mastery of course material may well be reasons why mastery learning increases student achievement, particularly for low-achieving students. When the objective is something other than acquiring information or skills, however—for example, when it is to wrestle with controversial and unresolved issues—a mastery approach may not be the method of choice.
CONTINGENCY CONTRACTS

Programmed instruction and mastery learning are instances of operant conditioning principles applied to the education of large groups of students. The amount of time needed to prepare materials for both of these techniques makes their use for only one or two students virtually impossible. When the learning or behavior of a single student is of concern, a contingency contract is often more practical.

A contingency contract is an agreement between a student and a teacher that specifies certain expectations for the student (the terminal behavior) and the consequences of the student’s meeting those expectations (the reinforcer). For example, a student and teacher may agree that the student should turn in all homework assignments on time and with at least 80% accuracy, every day for a week. If the student accomplishes this task, the contract might specify that the student will have some time to engage in a favorite activity, or that the teacher and student will spend time after school studying a topic of particular interest to the student. Although a contingency contract can be as simple as a verbal agreement, more often it is an actual written contract. The student and teacher negotiate the conditions of the contract in one or more meetings; both individuals then sign and date the contract.

A contingency contract can be used to reward academic accomplishment; it can also be used to modify classroom behavior. For example, a teacher might help a student spend more class time attending to assigned work, or to engage in more prosocial behaviors on the playground, by contracting with the student that certain behaviors will lead to desired consequences. Contingency contracting has been shown to be effective for addressing such diverse problems as poor study habits (Brooke & Ruthren, 1984; Miller & Kelley, 1994), juvenile delinquency (Rueger & Liberman, 1984; Welch, 1985), and drug addiction (Anker & Crowley, 1982; Crowley, 1984; Rueger & Liberman, 1984). It can also be a useful supplement to Keller’s personalized system of instruction (Brooke and Ruthren, 1984).

Guidelines for Writing Contingency Contracts

Teachers should keep several guidelines in mind when developing contingency contracts:

• The contract should specify the desired behavior of the student and the consequence (reinforcer) that will be contingent on that behavior. Both the desired behavior and the reinforcer should be specified in clear, precise terminology (Homme, Csanyi, Gonzales, & Rechs, 1970).

• Early contracts should require small tasks that a student can accomplish within a short period of time (Walker & Shea, 1995). Remember the problem with delayed reinforcement: Contracts that provide reinforcement only after the desired behavior has been exhibited for a lengthy period simply may not work.

• Reinforcement should be contingent on accomplishment of the desired behavior (Homme et al., 1970). Students occasionally tell their teacher that they tried to do a task but for one reason or another could not. Teachers who reinforce students only for successful completion of the task specified in the contract, not for their self-described unsuccessful efforts, will give students a clear message that task completion is essential for school success.

• A criterion for judging the quality of the desired behavior should be specified. When the task to be accomplished can differ considerably in quality from one student to another, as is true for an exam or a written composition, a criterion of successful completion of that task should be included in the contract. In the case of an exam, the criterion might be a percentage of correct items. For written work, some subjective judgment is almost inevitably involved in assessing the work; however, criteria that will be considered in the evaluation—specific content to be included, organization, clarity, grammar, and so on—should be clearly stated as a part of the contract.

A former colleague of mine once overlooked this critical principle when he used contingency contracts to assign grades in his college classes. For example, some contracts
stated that students would take exams on assigned readings without specifying acceptable scores for those exams. Other contracts read something like this: “For an A, the student will write a 10-page paper about operant conditioning,” without describing how well the paper was to be written or what topics should be included. My colleague found himself obligated to award As for multiple-choice exams with scores of 25% and for papers along the lines of “How I Shaped My Kid Brother at the Beach Last Summer.”

- When different contingency contracts are used with different students as a way of individualizing requirements for students, all contracts should nevertheless be equivalent in scope. Unless there are compelling reasons to do otherwise, contracts should require tasks that are equal in difficulty and reflect equal levels of competence for all students. The need for equivalence across contracts is particularly critical when the reinforcers used are course grades: Assigning grades based on student behaviors differing radically in difficulty level and quality typically renders those grades uninterpretable.

Contingency contracts are often used within the context of applied behavior analysis—a group of strategies for bringing about behavior change that are based on behaviorist principles. We turn to a discussion of such strategies now.

**APPLIED BEHAVIOR ANALYSIS**

Applied behavior analysis (ABA), sometimes known as behavior modification, behavior therapy, or contingency management, is probably the most straightforward application of operant conditioning principles. Based on the assumption that behavior problems are the result of past and present environmental circumstances, applied behavior analysis encompasses a number of procedures whereby an individual’s present environment is modified to promote the reinforcement of acceptable behaviors and the nonreinforcement of inappropriate ones. Central to ABA techniques are such operant conditioning concepts as reinforcement, extinction, shaping, stimulus control, and the reinforcement of incompatible behaviors. The concepts of punishment and modeling, though not components of Skinner’s model of operant conditioning, are also frequently used in ABA programs.

**Components of Applied Behavior Analysis**

Although ABA encompasses a number of different techniques, some strategies are common to many of them:

---

For an A, Mary Lamb will read one book somehow related to education.

Signed: Mary L.

Dr. Schmoe

For an A, John Goat will write a 500-page treatise on the use of computer-assisted instruction for teaching Chinese calligraphy to dysgraphic children.

Signed: John G.

Dr. Schmoe

When used to address individual students’ instructional needs, contingency contracts should be equivalent in scope.
Both the present behaviors and the desired behaviors are specified in observable, measurable terms. Consistent with behaviorist tradition, users of ABA focus their attention on specific, concrete responses. The actual behaviors to be increased or decreased are called target behaviors. For example, in a program designed to decrease a child’s aggressiveness, such target behaviors as screaming, hitting other people, and throwing objects might be identified (Morris, 1985).

An effective reinforcer is identified. As we noted in the preceding section, we should never assume that particular consequences will be reinforcing to particular students. Instead, we can identify one or more reinforcers that are likely to change students’ behavior by observing what they will work for or even by asking them outright. When an ABA program is instituted in a school setting, social reinforcers (such as praise) or activity reinforcers (such as special privileges or the opportunity to spend time with a classmate of one’s choice) are often effective (Bates, 1979; Brophy, 1981; Northrup et al., 1995; Piersel, 1987). In some cases, immediate feedback that a student has done something correctly is all the reinforcement a student needs, especially when it is not otherwise clear that the student has been successful (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Harris & Rosenthal, 1985; Kulik & Kulik, 1988). If material reinforcers are called for (primarily because other reinforcers don’t work), having parents provide those reinforcers at home for behaviors exhibited at school often works quite well (Barth, 1979; Kelley & Carper, 1988; Miller & Kelley, 1994; Wielkiewicz, 1986).

A specific intervention or treatment plan is developed. Developing a treatment plan involves determining the method by which the target behavior is to be modified. Sometimes a behavior’s frequency can be increased simply by reinforcing that behavior every time it occurs. When the free operant level (baseline) of a desired response is very low, however, that response may have to be shaped through the reinforcement of successively closer and closer approximations. An undesirable behavior can be eliminated through such methods as extinction, the differential reinforcement of other behaviors (a DRO schedule), the reinforcement of incompatible behaviors, or stimulus control (i.e., limiting the situations in which the behavior is allowed).

Behavior is measured both before and during treatment. Only through the objective measurement of the target behavior during both baseline and treatment can we determine whether a particular ABA procedure is effectively changing the target behavior. One way of measuring the target behavior is simply to count the overall frequency of a given response; for example, if we have designed a program to modify Johnny’s hitting, others behavior, we would count each instance of hitting. A second method of behavior measurement is to examine the rate of responding by counting the number of responses occurring within a specified time interval; for example, we might count the number of times Johnny hits in each hour of the day. Still a third method, called time sampling, involves dividing the time period during which the individual is being observed into equal intervals and then checking whether the target behavior occurred in each interval. For example, we might measure Johnny’s hitting behavior by dividing his school day into five-minute intervals and then identifying those intervals in which hitting was observed.

Behaviors frequently persist because they are either intentionally or unintentionally reinforced, so it is often helpful to record the consequences of the behavior as well as the behavior itself. In addition, many behaviorists (e.g., Rimm & Masters, 1974; Schloss & Smith, 1994; Sulzer-Azaroff, 1981) believe that antecedent events should also be noted to determine whether a behavior is under stimulus control. Figure 2–9 illustrates a time sample of Johnny’s hitting responses, with events antecedent and consequent to those responses also recorded. Behaviorists urge that target behaviors be observed and recorded as objectively as possible. Ideally, they recommend that one person (e.g., a teacher or therapist) administer the ABA intervention and at least two other individuals trained in observation techniques observe and record occurrences of the target behavior. If the method of behavior measurement is such that the behavior is being objectively and accurately recorded, the agreement between the recordings of the two observers (the interrater reliability) should be very high.
The treatment is monitored for effectiveness as it progresses and modified if necessary. When a desired behavior increases or an unwanted behavior decreases during the treatment program (compared with the baseline rate), the logical conclusion is that the ABA program is effective. When little change is observed from baseline to treatment, however, a modification of the program is warranted. Perhaps the teacher or therapist is trying to shape behavior too quickly. Perhaps the ‘reinforcer’ is not really reinforcing, and a different reinforcer should be substituted. Perhaps an undesired behavior that the teacher or therapist is attempting to eliminate through extinction is being maintained by reinforcers beyond his or her control. An unsuccessful treatment program should be carefully examined for these and other possible explanations for its ineffectiveness and then modified accordingly.

Measures are taken to promote generalization of newly acquired behaviors. Although people often generalize the responses they learn in one situation to other situations (Hall, Cristler, Cranston, & Tucker, 1970; Walker, Mattsen, & Buckley, 1971), there is no guarantee that they will do so. In fact, many ABA programs have limited success precisely because responses that are learned under some stimulus conditions do not generalize to others (Alberto & Troutman, 1990; Hughes, 1988; Schloss & Smith, 1994). Psychologists have suggested several strategies for promoting generalization during an ABA program:

- Teach the desired behavior in a wide variety of contexts, including many realistic ones; if possible, teach the behavior in the actual situations in which it is ultimately desired (Anderson-Inman, Walker, & Purcell, 1984; Emshoff, Redd, & Davidson, 1976; Hall et al., 1970; Haring & Liberty, 1990; Stokes & Baer, 1977).
- Teach many different versions of the behavior; for example, when teaching interpersonal skills, teach a variety of ways to interact appropriately with others (Stokes & Baer, 1977).
- Teach the relationship of the desired behavior to reinforcers that occur naturally in the environment; for example, point out that better personal hygiene leads to positive attention from others (Bourbeau, Sowers, & Close, 1986; Stokes & Baer, 1977).
- Reinforce the behavior when it spontaneously occurs in new situations; in other words, specifically reinforce generalization (Stokes & Baer, 1977).

Treatment is phased out after the desired behavior is acquired. Once the terminal behavior has been reached, the ABA program should be gradually phased out. In many instances, the newly learned behaviors begin to have their own rewards; for example, the aggressive student who learns more acceptable social behaviors begins to acquire new friends, and the student who has finally learned to read begins to feel successful and enjoy reading. In other situations, maintaining the target behavior may require intermittent reinforcement, such as a series of successively higher variable-ratio reinforcement schedules.

### Figure 2-9

A time sample of target behaviors in conjunction with antecedent and consequent events

<table>
<thead>
<tr>
<th>Antecedent</th>
<th>Target Behavior (hitting)</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>student teased him</td>
<td>no</td>
<td>scolded</td>
</tr>
<tr>
<td>none observed</td>
<td>yes</td>
<td>scolded</td>
</tr>
<tr>
<td>student hit him</td>
<td>no</td>
<td>none</td>
</tr>
</tbody>
</table>

(Times indicate start of each five-minute interval.)
Using Applied Behavior Analysis with Large Groups

Our emphasis up until now has been on the use of applied behavior analysis with individuals. But ABA techniques can also be used to change the behavior of groups of people (e.g., the behavior of an entire class of students). Two methods are particularly effective in working with groups: the group contingency and the token economy.

**Group Contingency**

In a group contingency, the entire group must perform a desired behavior for reinforcement to occur. For example, in one study (Lovitt, Guppy, & Blattner, 1969), the performance of a class of 32 fourth graders on their weekly spelling tests improved with a group contingency. In phase 1 of the study, baseline data indicated that about 12 students (38%) had perfect spelling tests in any given week. In phase 2, spelling tests were administered each of four days during the week; any student who obtained a perfect test score one day had free time on any successive days that the same test was repeated. During this individually based contingency period, the average number of perfect spelling tests a week more than doubled to 25.5 (80%). In phase 3, the individual contingencies of phase 2 continued to apply; in addition, when the entire class achieved perfect spelling tests by Friday, the class could listen to the radio for 15 minutes. The group contingency of phase 3 led to 30 perfect spelling tests (94% of the class) a week!

The "good behavior game" is an example of how a group contingency can reduce classroom misbehaviors. In research conducted by Barrish, Saunders, and Wolf (1969), a class of particularly unruly fourth graders (seven of the students had repeatedly been referred to the principal for problem behaviors) was divided into two teams whose behaviors were carefully observed during reading and mathematics lessons. Every time a team member engaged in out-of-seat or talking-out behavior, that team received a mark on its designated part of the chalkboard. The team that had fewer marks during the lesson received special privileges (e.g., first in the lunch line or free time at the end of the day); if both teams had five marks or fewer, both won privileges.

Figure 2-10 shows the results of Barrish and colleagues' study. Notice how baseline data were first collected for both math and reading periods. The good behavior game was instituted in the mathematics period on day 23; out-of-seat and talking-out behaviors decreased sharply during mathematics instruction while continuing at a high frequency during reading. On day 45, the game was initiated during reading instruction and stopped during math instruction, notice how the frequencies of misbehaviors changed accordingly. On day 51, the game was reinstated in the math period, and again the misbehavior decreased to a low level in that class. By the way, collecting data from two different situations (multiple baseline data) and switching from reinforcement to nonreinforcement and then back again (a technique called reversal) are common techniques in ABA research for ruling out coincidence as the reason for observed behavior changes.

Numerous other studies support the effectiveness of group contingencies, particularly when they are used within the context of cooperative learning activities (Barbetta, 1990; Johnson & Johnson, 1987; Pigott, Fantuzzo, & Clement, 1986; Slavin, 1983a, 1983b). Peer pressure and social reinforcement are clearly among the reasons that group contingencies are effective (O'Leary & O'Leary, 1972; Swenson, 1980). Misbehaving students are encouraged by other students to change their behaviors and are frequently praised when those changes occur (Johnson & Johnson, 1987; Slavin, 1983b). In addition, when increased academic achievement is the desired behavior, high-achieving students often assist their lower achieving classmates by tutoring and providing extra practice in their academic work (Bronfenbrenner, 1970; Johnson & Johnson, 1987; Pigott, Fantuzzo, & Clement, 1986).

**Token Economy**

The token economy, undoubtedly the most prevalent ABA technique in group settings, is a situation in which individuals who behave appropriately are reinforced with tokens—items that can later be traded in for backup reinforcers, which are objects or privileges
of each individual’s choice. For example, a teacher using a token economy in the class-
room might reinforce students with one poker chip for each completed assignment. Just
before lunch, students can use their poker chips to “buy” small treats, free time in the read-
ing center, or a prime position in the lunch line.

A token economy typically includes the following components:

1. A set of rules describing the responses that will be reinforced. The rules should
   be relatively few in number, so that they can be remembered easily.

2. Token reinforcers that can be awarded immediately when appropriate behaviors
   are exhibited. Such items as poker chips, checkmarks on a grid sheet, play
   money, or points can be used. Even class grades have been successfully used as
tokens (McKenzie, Clark, Wolf, Kothera, & Benson, 1968).

3. A variety of backup reinforcers (objects, activities, and privileges) for which
   tokens can be exchanged. Examples of backup reinforcers that have been shown to
   be effective in classroom token economies are free time (Osborne, 1969), par-
ticipation in special events (Bushell, Wrobel, & Michaels, 1968), and parent-
awarded allowance (McKenzie et al., 1968).

4. A “store” at which the backup reinforcers can be “purchased.” Young children
   should be allowed at least one purchase opportunity a day; for older children,
one or two opportunities a week may be sufficient.
Token reinforcers are advantageous because teachers can use them to reward individual behaviors immediately and conveniently within a group setting. The fact that students can trade tokens for many different backup reinforcers is another advantage; every individual can probably find at least one desirable item. The tokens themselves often become effective reinforcers (Hundert, 1976); perhaps they become secondary reinforcers through repeated association with other reinforcing objects and events, or perhaps they are effective simply because they provide feedback that students are doing something right.

Adding a Cognitive Component to ABA

In recent years, many practitioners have added a cognitive element to ABA techniques, using such terms as cognitive behavior modification, cognitive behavior therapy, or cognitive-behavioral intervention to describe their approach (Elliott & Busse, 1991; Hughes, 1988; Yell, 1993; Zerpol & Melloy, 1993). In such approaches, the teacher or therapist frequently models the desired behavior, the assumption being that such modeling helps the student understand the particular behavior that is desired and so facilitates the learning process. Another common strategy is coaching, whereby the teacher or therapist verbally instructs and guides the student as the latter practices appropriate behaviors. Cognitive approaches also focus on problem solving; for example, the teacher or therapist might ask the student to think carefully about the effects that various behaviors may have in problem situations and to choose those behaviors that are likely to bring about desired consequences.

Effectiveness of ABA

Applied behavior analysis has often been shown to bring about behavior change, and it frequently works where other techniques fail (e.g., O’Leary & O’Leary, 1972). Numerous studies point to its effectiveness in improving academic performance and study habits (Braukmann, Ramp, & Wolf, 1981; Glover & Gary, 1976; Harris & Sherman, 1973; Iwata, 1987; Lovitt et al., 1969; McLaughlin & Malaby, 1972; McLaughlin & Williams, 1988; McNamara, 1987; Piersel, 1987; Rapport & Bostow, 1976). It is also useful in improving such behaviors as attention (Packard, 1970), social skills (Braukmann et al., 1981; Iwata, 1987; McLaughlin & Williams, 1988; Schloss & Smith, 1994), and cleanliness (Taylor & Kratochwill, 1978). Furthermore, it can effectively reduce such undesirable behaviors as hyperactivity, impulsivity, aggression, and violence (Ayllon, Layman, & Kandel, 1975; Braukmann et al., 1981; Frankel & Simmons, 1989; Mayer & Butterworth, 1979; Northrup et al., 1995; Plummer, Baer, & Leflanc, 1977; Shafts & Sulzbacher, 1977; Wulbert & Dries, 1977).

Applied behavior analysis is particularly beneficial for students who must be continuously motivated to engage in appropriate academic and social behaviors. It is therefore used frequently in the education and therapy of students with special needs, especially those with either learning difficulties or behavioral problems (Braukmann et al., 1981; Haring, Roger, Lee, Breen, & Gaylord-Ross, 1986; Hobbs & Holt, 1976; McLaughlin & Williams, 1988; Northrup et al., 1995; O’Leary & Becker, 1967; Plummer et al., 1977; Witt, Elliott, & Gresham, 1988; Wolf, Braukmann, & Ramp, 1987).

Although we know that ABA techniques work, we don’t always know just why they work. One likely factor underlying their effectiveness is the use of clearly specified response-reinforcement contingencies. Because desired behaviors are described in specific, concrete terms, students know exactly what is expected of them. And the immediate feedback that students receive through reinforcement provides them with clear guidance as to when their behaviors are on target and when they are not.

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Although instructional techniques based on operant conditioning principles are clearly effective, such techniques are not without their critics. Some criticisms are probably ill founded, while others should be considered more seriously. We first examine some of the common bogus complaints and then turn to more genuine concerns.

Bogus Complaints

Many criticisms directed toward the use of reinforcement in the classroom reflect either a misunderstanding of operant conditioning principles or an ignorance of empirical findings. Following are some typical examples of such criticisms:

- Reinforcement is bribery. The bribery argument is probably the most frequent complaint leveled against the use of reinforcement in the classroom. However, the word bribery implies that the behavior being reinforced is somehow illegal or unethical. On the contrary, the appropriate use of reinforcement in the classroom can facilitate the attainment of educational objectives, all of which involve academically and socially desirable behaviors.

- Reinforcement develops dependence on concrete, external rewards for appropriate behavior. Some critics propose that students should engage in learning simply for learning’s sake; by reinforcing learning, they argue, teachers foster the expectation that students will always receive rewards for their accomplishments. This argument can be countered in two ways. First of all, ABA techniques do not necessarily involve material reinforcers. Social reinforcers, activities, feedback, and intrinsic reinforcers (e.g., feelings of success or accomplishment) are also effective in changing behavior, and the sensible teacher will use them instead of material reinforcers whenever possible.

  Second, even when a teacher must use material reinforcers to change behavior, these reinforcers bring about desired changes in a student—changes that apparently will not occur any other way. Reinforcement is often used when more traditional methods of changing behavior have failed to increase important academic and social skills or to decrease counterproductive behaviors. If the choice comes down to either teaching Mary to read by reinforcing her for reading or else not teaching her to read at all, obviously Mary must learn to read through whatever means possible. We must remember, too, that when material reinforcers are used, social events (e.g., praise) that are paired with them should eventually become secondary reinforcers and so can be used instead.

- Reinforcing one student for being good teaches other students to be bad. “Hmmm,” Leslie thinks. “Linda has been such a loudmouth the past few weeks that the teacher is now giving her raisins so she’ll keep quiet. Maybe if I start shooting my mouth off, I’ll start getting some raisins, too.” If students are thinking along these lines, then something is clearly wrong with the way reinforcement is being administered in the classroom. All students should be reinforced for their appropriate behaviors. Praise and positive feedback should not be limited to a handful of chronic misbehavers but should be awarded consistently to all students. If the behavior of a particular student can be modified only with material reinforcers such as raisins, such reinforcement should be administered discretely and in private.

- Changing a problem behavior does not change the underlying cause of that behavior; other behavioral manifestations of that underlying cause will appear. Reflected in this criticism is Sigmund Freud’s notion of symptom substitution: Problem behaviors are a function of deep-rooted psychological conflicts, so that when a behavior is eliminated without treatment of its underlying cause, another problem behavior will emerge in its place. The best rebuttal to the symptom substitution criticism is an empirical one: When problem behaviors are treated through applied behavior analysis, symptom substitution rarely occurs (e.g., Rimm & Masters, 1974).
One likely reason for this finding is that changing an individual's behavior may indirectly address its underlying causes as well. For example, consider the girl who is inappropriately aggressive on the playground. This girl might truly want to interact with her classmates, but aggression is the only way she knows of initiating that interaction. Reinforcing the girl for more appropriate methods of social interaction not only helps her develop friendships but also addresses the underlying cause for her aggression—her desire for companionship.

Genuine Concerns

The bogus complaints just listed can be easily rebutted. Three major criticisms of operant conditioning techniques should be taken more seriously, however:

- **Attempts at changing behaviors ignore cognitive factors that may be interfering with learning.** When students are capable of learning a new skill but are not motivated to do so, the use of reinforcement may be all that is needed to bring about the desired behavior change. But when cognitive deficiencies (e.g., specific learning disabilities) exist that interfere with the acquisition of a new skill, reinforcement alone may be insufficient. In the latter situation, teachers may need to employ teaching techniques based more on cognitive learning theories—theories that we explore in later sections.

- **Reinforcement of particular predetermined behaviors sometimes interferes with maximal learning and performance over the long run.** Reinforcement for accomplishing a certain task focuses students' attention and effort more on getting that task done quickly, perhaps at a minimally acceptable level, than on learning from that task (Brophy, 1986; Clifford, 1990; Lepper & Hodell, 1989; McGavin & Good, 1996). When teachers want their students to engage in complex, higher-level thinking—for example, to think flexibly and creatively about the subject matter—then extrinsic reinforcement simply for task accomplishment may sometimes be counterproductive (Brophy, 1986; Deci & Ryan, 1985; Hennessey & Amabile, 1987; Lepper & Hodell, 1989).

- **Extrinsic reinforcement of a behavior already motivated by intrinsic reinforcement may undermine the intrinsically reinforcing value of that behavior.** Individuals often engage in activities because of the intrinsic rewards—for example, pleasure or feelings of success—that those activities bring. A number of research studies indicate that enjoyable activities can be increased by extrinsic reinforcers but will then decrease to a below-baseline frequency once the extrinsic reinforcers are removed (Bates, 1979; Lepper & Greene, 1978; Lepper & Hodell, 1989). For example, in one study, preschool children who had previously been reinforced for certain drawing activities were actually less likely to engage in drawing in a free-play situation than children who had not been reinforced (Lepper, Greene, & Nisbett, 1973). Similar results have been obtained in a study with college students: Students who received a dollar for each correct solution of a series of block puzzles were less likely to continue to work at such puzzles in the absence of reinforcement than students who had not been paid for their correct solutions (Deci, 1971). It appears, then, that externally reinforcing a behavior that is already occurring because of intrinsic motivation may actually undermine that intrinsic motivation (deCharms, 1968, 1984; Deci, 1992; Deci & Ryan, 1985, 1987; Fabes, Paltz, Eisenberg, MayPumlee, & Christopher, 1989; Gottfried, Fleming, & Gottfried, 1994; Lepper & Hodell, 1989; Spaulding, 1992). We will identify a possible reason for this puzzling finding in our discussion of motivation in Section Three.

WHEN OPERANT CONDITIONING TECHNIQUES ARE MOST APPROPRIATE

Instructional methods based on principles of operant conditioning are probably more appropriate for certain groups of students than for others. Among the students who
appear to benefit the most from the structure and clearly specified response-reinforcement contingencies of operant conditioning techniques are students with a history of academic failure, poorly motivated students, anxious students, and students for whom nothing else works.

Frequent success experiences and reinforcements, such as those provided by programmed instruction, are particularly beneficial to students who have previously had little success in their academic careers (e.g., Gustafsson & Undheim, 1996; Snow, 1989). Children officially identified as "developmentally delayed" or "learning disabled" fall into this category, as do many juvenile delinquents and "slow learners" (children with below-normal intelligence whose test scores are not sufficiently low to qualify them for special educational services). Academic success is exactly what such students need to bolster the poor self-esteem that has resulted from a long string of academic failures.

Students with little motivation to engage in academic tasks can also benefit from operant conditioning techniques. Although some students thrive on the feelings that academic success can bring, others do not value academic achievement. The introduction of extrinsic reinforcers (material, social, or activity reinforcers) contingent on academic accomplishments may be helpful in motivating seemingly "uninterested" students to master essential skills (Covington, 1992; Lepper, 1981).

Highly anxious students appear to need structure in their curriculum to perform well on academic tasks (Dowaliby & Schumer, 1973; Grimes & Allinsmith, 1961; Helmke, 1988, 1989). Such students need a classroom environment that specifies expectations for behavior and clearly lays out response-reinforcement contingencies. They also seem to require frequent success experiences and positive feedback. Many of the methods derived from operant conditioning principles address the needs of anxious children particularly well. Instructional objectives spell out desired behaviors in concrete terms, programmed instruction provides success and positive feedback, and ABA techniques clearly communicate which behaviors will yield the reinforcers the students seek.

Finally, there are some students for whom nothing else works. Techniques based on operant conditioning principles have been shown to be effective methods of changing even the most resilient of problem behaviors (Greer, 1983; Rimm & Masters, 1974). Such stubborn problems as childhood autism and juvenile delinquency have been dealt with more successfully by applied behavior analysis than by any other method currently available.

Yet methods based on operant conditioning are probably not well suited for everyone. Bright students may find the gradual, inch-by-inch approach of programmed instruction slow and tedious. A token economy in a classroom of highly motivated college-bound students may undermine the intrinsic desire of these students to achieve at a high level. Other learning theories, notably cognitive theories, are probably more useful for helping these students learn.

SUMMARY

Instructional objectives, and especially behavioral objectives (which express educational goals in terms of precise, observable responses), are a direct outgrowth of the concept of terminal behavior. Objectives facilitate communication among students and teachers; they also help in the selection of appropriate instructional strategies and evaluation techniques. Objectives tend to focus teachers’ and students’ attention toward the information and skills they identify (an advantage) and away from other information and skills (a possible disadvantage).

Programmed instruction, computer-assisted instruction, and mastery learning incorporate such operant conditioning principles as active responding, shaping, and immediate reinforcement. Although noncomputer-based programmed instruction is probably no more effective than traditional instructional methods, computer-assisted instruction and mastery learning have frequently been shown to facilitate student achievement.
A contingency contract provides a means through which a teacher and student can specify the behavior expected of the student and the consequence (reinforcer) that will follow such behavior. Reinforcement is also a key ingredient of applied behavior analysis, which can be used with students either individually or on a group basis. Contingency contracts and applied behavior analysis have been shown to improve both academic and social behavior.

Use of reinforcement in the classroom has drawn a number of criticisms; some reflect a misunderstanding of common behaviorist practices, but others are legitimate. Operant conditioning techniques are probably best used with certain kinds of students (e.g., those with high anxiety, poor motivation, or a history of academic failure) rather than as a matter of course with all students.

NOTES

1 For example, some schools use an approach called outcomes-based education, in which the desired objectives (“outcomes”) of instruction are clearly delineated in advance, decisions about students’ grades, promotion to higher grade levels, and high school graduation are based on whether students have achieved those objectives (e.g., Boschee & Baron, 1993; Guskey, 1994).

2 We should note here that, in one study with undergraduate students, occasional 10-second delays in feedback actually enhanced students’ learning, apparently because the delays gave students more time to study the material in front of them (Crosbie & Kelly, 1994).
In our discussion of operant conditioning, we focused on the role that desirable consequences (reinforcers) play in learning and behavior. In this section, we will look at the impact of aversive events on learning and behavior, with particular attention to three different situations. We will first examine how people and animals learn to escape and avoid unpleasant situations and then look at the effects of punishing consequences on learning and behavior. Finally, we will examine a phenomenon that occurs when people and animals are exposed to aversive stimuli that they can neither avoid nor escape—a phenomenon known as learned helplessness.

**ESCAPE AND AVOIDANCE LEARNING**

My university, like most others, abounds in faculty committees. When I first joined the faculty as an assistant professor, I eagerly agreed to serve on committees whenever I could, perceiving them to be a means of meeting other faculty members and having input into university decision making. Before long, however, I discovered that most faculty committees spend years chewing on the same old issues without ever arriving at consensus or otherwise accomplishing very much. Frustrated by the amount of time I was wasting, I soon found myself inventing excuses to leave committee meetings early ("I’m so sorry, but I have to..."

*Taken from* Human Learning, Third Edition by Ormrod.
take my son to the dentist”). Eventually, I stopped volunteering to join committees in the first place, thus avoiding them altogether. Committee meetings had become an aversive event for me. My learning to make excuses so I could leave meetings early and then learning not to serve on committees at all is typical of what happens when an aversive stimulus is presented: Organisms learn to escape and eventually to avoid that stimulus if they possibly can.

**Escape Learning**

Escape learning is the process of acquiring a response that terminates an aversive stimulus. For example, in Neal Miller’s (1948) classic study of escape learning, rats were placed in one compartment of a two-compartment cage and then given a series of electric shocks. The rats quickly learned to turn a wheel that enabled them to run to the other compartment, thereby escaping the aversive shocks. In an analogous study with humans (Hiroto, 1974), people readily learned to move a knob to turn off an unpleasantly loud noise.

Just as in the laboratory, students learn various ways of escaping unpleasant tasks or situations in the classroom. Making excuses (“My dog ate my homework!”) and engaging in inappropriate classroom behaviors provide means of escaping tedious or frustrating academic assignments (e.g., Taylor & Romanczyk, 1994). Lying about one’s own behaviors (“I didn’t do it—he did!”) is a way of escaping the playground supervisor’s evil eye. Chronic truancy and hypochondria are ways of escaping the school environment altogether.

Because escape from an aversive stimulus terminates that stimulus, the escape response is negatively reinforced. When rats make a response that stops an electric shock, when children make a response that terminates the evil eye, and when I make an excuse to leave a committee meeting, we are all reinforced by virtue of the fact that an unpleasant event is removed.

The more aversive a stimulus is, the more likely people are to learn to escape that stimulus (Piliavin, Dovidio, Gaertner, & Clark, 1981; Piliavin, Piliavin, & Rodin, 1975). For example, children who have particular difficulty with assignments are more likely to have dogs who have allegedly eaten their homework. And truancy is most likely to occur when school is a very unpleasant environment for a student; chronic truants are often those students who have encountered repeated failures both in their academic work and in their relationships with teachers and peers.

**Avoidance Learning**

Avoidance learning is the process of learning to stay away from an aversive stimulus altogether. For avoidance learning to occur, an organism must have some sort of pre-aversive stimulus, a cue signaling the advent of the aversive stimulus. For example, rats who hear a buzzer (the pre-aversive stimulus) and are then given an electric shock easily learn to jump a hurdle as soon as the buzzer sounds, thereby avoiding the painful shock (Mowrer, 1938, 1939). Similarly, children quickly learn to pull a brass handle as soon as a light flashes so that they can avoid an unpleasantly loud noise (Robinson & Robinson, 1961).

Avoidance learning appears in two forms: active avoidance learning and passive avoidance learning. In active avoidance learning, the organism must actively make a particular response to avoid an aversive event. To illustrate, studying behavior is, in many cases, an instance of active avoidance learning. Ideally, studying should be an enjoyable activity in its own right (thereby providing intrinsic reinforcement), but unfortunately many people do not enjoy it in the least (I, for example, would much rather read a mystery novel or watch a television game show). Yet by studying fairly frequently, most students are able to avoid an aversive stimulus—a failing grade. But notice how rarely studying behavior occurs when there is no signal of possible impending doom (i.e., no pre-aversive stimulus), such as an assigned research report or an upcoming exam.

In other situations, organisms learn that not making a particular response allows them to avoid an aversive event (e.g., Lewis & Maher, 1965; Seligman & Campbell, 1965); this form...
of learning is called **passive avoidance learning**. For example, people who feel awkward and uncomfortable in social situations tend not to go to parties or other social events. Likewise, students who have difficulty with mathematics rarely sign up for advanced math classes if they can help it.

What learning processes underlie avoidance learning? An early and widely cited theory of avoidance learning is Mowrer's two-factor theory (Mowrer, 1956; Mowrer & Lamoreaux, 1942). According to Mowrer's theory, avoidance learning is a two-step process that involves both classical conditioning and operant conditioning. In the first step, because the pre-aversive stimulus and the aversive stimulus are presented close together in time, the organism learns to fear the pre-aversive stimulus through a process of classical conditioning, as illustrated in Figure 2–11. In the second step, an avoidance response results in negative reinforcement, because it leads to escape from the fear-inducing pre-aversive stimulus.

![Figure 2–11](pre-aversive stimulus) Learning to fear a pre-aversive stimulus through classical conditioning.

Logical as Mowrer's proposal may appear, research does not completely support it. For example, rats can learn to avoid an aversive stimulus even when they are unable to escape the pre-aversive stimulus (Kamin, 1956); this finding refutes Mowrer's notion that escape from the pre-aversive stimulus negatively reinforces the avoidance response. Furthermore, once an avoidance response has been well learned, organisms may exhibit little if any fear of the pre-aversive stimulus; thus, the avoidance response can no longer be negatively reinforced by a reduction of that fear (e.g., Kamin, Brimer, & Black, 1963).

Since Mowrer's time, several other theories of avoidance learning have been advanced (e.g., Bolles, 1975; D'Amato, 1970; Herrnstein, 1969; Seligman & Johnston, 1973). For example, some theorists postulate that the actual reinforcer of an avoidance response is a feeling of relief (D'Amato, 1970; Denny & Weisman, 1964). However, because avoidance behavior can occur in the absence of fear, other theorists (e.g., Bolles, 1975; Seligman & Johnston, 1973) have abandoned behaviorism for a cognitive explanation of avoidance learning: Organisms form expectations about what situations are aversive and what behaviors enable them to avoid those situations.

**Extinguishing Avoidance Responses**

Although disagreement exists about the best theoretical explanation of avoidance learning, there is general agreement about one thing: Avoidance responses are difficult to extinguish. When a previously aversive situation loses all sources of unpleasantness, organisms nevertheless continue to avoid it. For example, dogs will continue to escape from a box that has been previously associated with shock long after the shock has been eliminated (Solomon & Wynne, 1954).

One likely reason for the high resistance of avoidance responses to extinction is that when an organism avoids a formerly aversive situation, it has no opportunity to learn that the situation is no longer aversive. Let's consider students' avoidance of mathematics as an example. Mathematics anxiety may be a conditioned response acquired at a time when children are not cognitively ready to learn abstract mathematical concepts. Students with math anxiety may avoid math classes indefinitely, even though they may eventually develop...
the cognitive maturity necessary for comprehending previously troublesome concepts. If
students never again enroll in another math class, they will never learn that they have noth-
ing to fear.

Many psychologists believe that the best way to get rid of an avoidance response is to
 extinguish the fear that leads to the avoidance behavior in the first place. One way of extin-
guishing this fear is through systematic desensitization. Having someone relax while imag-
ing a series of increasingly anxiety-arousing scenarios can reduce fear of certain situations,
such as mathematics or public speaking engagements. Another approach is to prevent a
person from making the avoidance response; by doing so, we create an occasion in which
the person experiences the conditioned stimulus without the fear-eliciting unconditioned
stimulus (and so we promote the extinction of a classically conditioned fear response). For
example, if we have a math-anxious student who we know possesses adequate cognitive skills
to succeed in mathematics, we might require that student to enroll in a math class; once in
class, the student can discover that mathematics is a rewarding experience rather than a frus-
trating one. In some circumstances, it is probably true that students don’t always know what
is best for them!

Undoubtedly, the best way to deal with both escape and avoidance behaviors in the
classroom is to prevent such behaviors from being learned in the first place—something
we can accomplish only by minimizing aversive classroom stimuli. For example, teachers
should have students’ existing knowledge, skills, and cognitive maturity in mind when they
develop instructional objectives, and they should then provide the resources and assis-
tance that students need to accomplish those objectives successfully. When students achieve
success at classroom tasks (a positive reinforcer), rather than experiencing frustration and
failure at every turn, they are more likely to seek out those tasks than to avoid them.

In escape learning and avoidance learning, an organism makes a response that allows
it to either terminate or avoid an aversive stimulus—a stimulus that, especially in the case
of escape learning, is already present in the environment. But when an aversive stimulus
occurs only after the organism makes a response, we have an instance of punishment instead.
We turn to an examination of this phenomenon now.

PUNISHMENT

Punishment actually takes two forms. Punishment I (also called positive punishment) is
the more commonly recognized form; it decreases the strength of a response when it is
presented after that response. Typically, Punishment I involves the presentation of an aver-
sive stimulus (e.g., a spanking or a failing grade). Punishment II (sometimes called nega-
tive punishment) decreases the strength of a response by virtue of the removal of a stimulus,
usually a pleasant one. Losing a privilege and being fined (in which case money is lost) are
eamples of Punishment II. Punishment is a common occurrence in our daily lives; some
psychologists believe that even the absence of reinforcement can be punishing.

Views on the effectiveness of punishment have changed considerably over the past 60
years. Early research indicated that punishment was a very ineffective means of changing
behavior. For example, Thorndike (1932b) found that, although positive feedback facil-
tated students’ learning of correct responses, negative feedback did not reduce incorrect
responses. Similarly, Skinner (1938) found that when rats were punished for a response
that had previously been reinforced, the response was temporarily suppressed but soon
returned to its prepunishment frequency. As a result, many early behaviorists discouraged
the use of punishment.

Probably because of the negative views of punishment held by prominent learning the-
orists during the first half of the century, punishment as a means of behavior control was
largely ignored until the 1960s. Until that time, concern centered more on disadvantages than
on any possible advantages of punishment. More recently, however, research evidence has emerged to indicate that punishment can be effective in many situations.

In the following pages, we will explore the many-faceted topic of punishment. We will begin by examining punishment’s numerous disadvantages. We will then look at evidence supporting the use of punishment as an effective means of behavior change and consider various theoretical explanations for its effect on behavior. Finally, we will discuss some guidelines for using punishment effectively in classroom contexts.

Disadvantages of Punishment

Over the years, psychologists have cited a number of disadvantages associated with the use of punishment:

• A punished behavior is not eliminated; it is only suppressed. Punishment suppresses a response, making it less likely to occur. However, this suppression effect is often only temporary. The punished behavior may eventually reappear, perhaps when the punishment stops or when the punisher is absent (Appel & Peterson, 1965; Azrin, 1960; Griffere, 1981; Holz & Azrin, 1962; Skinner, 1938).

• Punishment sometimes leads to an increase in the punished behavior. In some cases, this effect may be due to the fact that the ‘punishment’ is actually reinforcing. For example, a teacher’s reprimands may be reinforcing to the girl who craves her teacher’s attention or to the boy who wants to look ‘cool’ in front of his classmates. Yet even in situations in which the punishment is truly punishing, it may nevertheless lead to an increase in the response that it follows. More specifically, when a behavior is punished in one situation, it may decrease in that situation but increase in a situation in which it has not been punished—an effect known as behavioral contrast (e.g., Reynolds, 1975; Swenson, 1980). For example, some children who behave badly at school may be described by their parents as being little angels at home. Such children are possibly being held to strict behavioral rules on the home front, with severe punishment following any infractions; if so, they may engage in the forbidden behaviors at school, where they can do so with milder consequences.

• The response-punishment contingency may not be recognized. Punishment, particularly physical punishment, can distract an individual’s attention away from the behavior that was punished. People are often less aware of the response that was punished than they are of the punishment itself (Maurer, 1974). Punishment is clearly ineffective if people do not know what they are being punished for.

• Punishment often elicits undesirable emotional responses and may lead to escape and avoidance behaviors. When punishment involves a particularly aversive stimulus, the association of that stimulus with other stimuli (e.g., with the punisher or with the situation in which punishment occurred) can, through classical conditioning, lead to undesirable emotional responses to those other stimuli (Skinner, 1938). For example, when a teacher punishes a student at school, that punishment (the UCS) may be associated with the teacher, the task, or the classroom, any of which may then become conditioned stimuli (CSs) that elicit conditioned responses (CRs) such as fear and anxiety. In a similar manner, when a baseball coach continually yells at children for their poor performance during a game, negative attitudes toward baseball are likely to result (Smith & Smoll, 1997). Furthermore, a stimulus that has become fear inducing because of its association with punishment may lead to escape or avoidance behavior (e.g., Redd, Morris, & Martin, 1975). Escape and avoidance responses at school take many forms, including inattention, cheating, lying, refusal to participate in classroom activities, and truancy (e.g., Becker, 1971; Skinner, 1938; Taylor & Romanczyk, 1994).

• Punishment may lead to aggression. When punishment produces pain, it evokes emotional arousal in an individual—arousal that may result in anger and aggression, especially in characteristically aggressive individuals (Azrin, 1967; Berkowitz & LePage, 1967; Walters & Grusec, 1977). Aggressive behavior appears to reduce such emotional arousal and,
more generally, to “feel good,” the result being that aggression is reinforced (Bramel, Taub, & Blum, 1968; Hokanson & Burgess, 1962).

Furthermore, some forms of punishment provide a model of aggression, thus communicating the message that aggression is acceptable. I am reminded of the many hypocritical interactions I have witnessed in the grocery store. A mother yells, “How many times have I told you not to hit your sister!” and gives her child a solid whack. Children who observe others being aggressive are more likely to be aggressive themselves (Bandura, Ross, & Ross, 1961, 1963; Mischel & Grusec, 1966; Steuer, Applefield, & Smith, 1971). Particularly aggressive children (i.e., juvenile delinquents) are likely to come from homes where severe punishment has been frequent (Welsh, 1976).

- Punishment does not illustrate the correct behavior. As Skinner (1938) pointed out, punishment tells an individual what not to do but not what should be done instead. Consider the boy who is consistently aggressive on the playground; perhaps aggression is the only way he knows of interacting with other children. Punishing this child for aggressive behavior without simultaneously teaching him more appropriate social skills does little to help him develop friendly relationships with his classmates.

- Severe punishment may cause physical or psychological harm. Obviously, severe physical punishment can lead to bodily injury. Severe psychological punishment, such as extreme embarrassment or deflation of one’s self-esteem, can be equally harmful. The mother of a college friend of mine constantly degraded my friend with such remarks as “How can you be so stupid!” and “Can’t you ever do anything right?” Throughout our four years in college, my friend fought numerous bouts with depression and was in and out of mental institutions. The line between punishment and abuse is often a very fuzzy one.

Despite these many potential disadvantages, punishment can be an effective method of bringing about desired behavior change. In the next few pages, we will look at some instances in which punishment does work. A bit later in the section, I will offer some guidelines for using punishment that can help avert the disadvantages I have just listed.

**Effectiveness of Punishment**

Although early research cast doubt on the idea that punishment decreases the responses it follows, researchers have more recently reported evidence that punishment can successfully reduce or eliminate undesirable behaviors (Azrin & Holz, 1966; Dinsmoor, 1954, 1955; Rachlin, 1953; Tannen & Zelens, 1975; Walters & Grusec, 1977). Punishment is often used when methods such as extinction, the differential reinforcement of other behaviors (DRO schedule), or the reinforcement of an incompatible response are ineffective or impractical. Furthermore, it appears that punishment may often be more effective than any of these other techniques (Boe & Church, 1967; Corte, Wolf, & Locke, 1971; Frankel & Simmons, 1985; Pfiffner & O’Leary, 1987; Walters & Grusec, 1977). Punishment is especially advised when a behavior might harm either oneself or others; in such cases, using punishment to eliminate such behavior rapidly may actually be the most humane course of action.

In a series of studies, Vance Hall and his colleagues (Hall, Axelrod, Foundopoulos, Shellman, Campbell, & Cranston, 1971) have demonstrated the speed with which punishment can bring about behavior change. For example, in one study, consistent punishment virtually eliminated the aggressive behavior of a seven-year-old deaf girl named Andrea. Initially, this girl pinched and bit both herself and anybody else with whom she came into contact; the frequency of such responses (an average of 72 per school day) was so high that normal academic instruction was impossible. Following a baseline period, punishment for each aggressive act began: Whenever Andrea pinched or bit, her teacher pointed at her sternly and shouted “No!” Figure 2–12 shows the changes in Andrea’s behavior (the brief reversal to nonreinforcement for a few days was used to rule out coincidence as an explanation for the behavior changes). Even though Andrea was deaf, the shouting and pointing virtually eliminated her aggressiveness.
In a second study, Hall and his colleagues modified the whining and complaining behaviors of a boy named Billy. Billy frequently cried, whined, and complained of stomachaches whenever he was given a reading or arithmetic assignment, while apparently being quite healthy the rest of the day. The treatment program consisted of giving Billy five slips of colored paper bearing his name at the beginning of reading and arithmetic periods every day and then removing one slip of paper (Punishment II) each time Billy cried, whined, or complained. Treatment was instituted on day 6 for Billy’s reading period and on day 11 for his math period (this multiple baseline approach was used to rule out the coincidence factor). Figure 2–13 shows the effectiveness of such obviously mild punishment (note the temporary reversal to nonpunished baseline similar to that shown in Figure 2–12).

In yet another study by Hall and his colleagues, three 10th-grade students enrolled in a French class earned higher grades when after-school tutoring was the “punishment” for low grades. These students—Dave, Roy, and Debbie—had been consistently earning Ds and Fs on daily quizzes. Their teacher informed them that because they were obviously having difficulty with their French, they would have to come in for a half hour of tutor-
ing after school whenever they received a grade lower than C. Quiz grades during base-
line and during the time when poor quiz performance would be punished are shown in
Figure 2–14 (note the multiple baseline approach once again). As you can see, none of
the students ever needed to report for after-school tutoring. Apparently, the threat of
punishment alone was sufficient to bring about desired study behaviors.

What is unique about the studies by Hall and his colleagues is that none of the
punishments could be construed as being either physically or psychologically harmful.
Yet all of them—pointing and yelling ‘No,’ taking away colored slips of paper, and require-
ing after-school tutoring—were clearly effective in bringing about dramatic behavior
changes in different students. But just why does punishment work? Let’s explore some
possible explanations.

Theoretical Perspectives on Punishment

Several theories have been advanced to explain why punishment decreases the behavior
that precedes it. Guthrie (1935) and Skinner (1953) offered two early theories based on
the notion of incompatibility: Punishment reduces a response only when it leads to a behav-
ior (such as escape from the situation) that is incompatible with the punished response. Thus,
Guthrie and Skinner argued that punishment affects the punished behavior indirectly (by
bringing about a new response) rather than directly. An alternative theory (Estes, 1969b;
Walters & Grusec, 1977) is also based on the notion of incompatibility, albeit the incom-
patibility of motives rather than behaviors. According to this explanation, punishment leads
to motives (e.g., fear) incompatible with the motives that originally led to the behavior being
punished. For example, when a rat that has learned to press a bar to obtain food is then pun-
ished for pressing the bar, the fear induced by the punishment may lower the rat’s appetite.

Mowrer (1960) proposed a two-stage theory of punishment similar to his theory of
avoidance learning. First, when an organism is punished for a particular behavior, fear of
the environment in which punishment occurred is established through a process of classi-
cal conditioning. Second, escape from that environment is reinforced because such escape
reduces that fear (negative reinforcement). Punishment is effective to the extent that the
escape response is incompatible with the punished response. In contrast, Aronfreed (1968;
Aronfreed & Reber, 1965) proposed that anxiety is associated not with stimuli in the environment but with the initiation of the punished response and perhaps also with the thoughts that precede the response; suppressing the response—not emitting it—is negatively reinforced by anxiety reduction.

Still other theorists (e.g., Azrin & Holz, 1966; Fantino, 1975; Rachlin, 1991; Rachlin & Hermstein, 1969) have reverted to Thorndike’s original law of effect and view punishment in the same way they view reinforcement—as a consequence that alters the frequency of future behaviors. Many of these researchers advocate an atheoretical approach to punishment; they focus more on the factors influencing the effectiveness of punishment than on the reasons underlying its effectiveness (Walters & Grusec, 1977).

Using Punishment in Classroom Settings

The use of punishment as a means of behavior control is widespread in both child rearing and educational practice (Sears, Maccoby, & Levin, 1957; Wielkiewicz, 1986). One likely reason for the prevalence of punishment as a disciplinary measure is that, because it tends to decrease or eliminate an undesirable behavior fairly quickly, the punisher is negatively reinforced: By using punishment, he or she gets rid of an unwanted state of affairs.

Two particular forms of punishment—time-out and response cost—are frequently used in classroom situations. Both involve the withdrawal of reinforcers and so are examples of Punishment II. Three other types of punishment—verbal reprimands, restitution, and overcorrection—are also useful in some instances; these involve imposing unpleasant consequences and so are examples of Punishment I. Let’s examine the evidence for each of these.

Time-Out

Time-out (Alberto & Troutman, 1990; Ullmann & Krasner, 1969; Walters & Grusec, 1977; Zirpoli & Melloy, 1993) involves placing the misbehaving individual in an environment with no reinforcers—in other words, in a dull, boring situation. Often, this time-out environment is a separate room, furnished sparsely or not at all, in which the individual cannot interact with others. At other times, it may be a corner of the classroom screened from the rest of the room by partitions or tall furniture. In any event, the time-out environment should be neither reinforcing, as the hall or the principal’s office is likely to be, nor frightening, as a dark closet might be (Walker & Shea, 1995; Wielkiewicz, 1986). Foxx and Shapiro (1978) have developed a procedure that easily incorporates time-out into a classroom context without requiring any special facilities. Students wear ribbons that make them eligible to participate in rewarding classroom activities. Students who misbehave remain in the classroom, but their ribbons are removed, making them ineligible to receive the reinforcers available to their classmates.

Time-out effectively reduces a variety of disruptive, aggressive, and dangerous behaviors (Frankel & Simmons, 1985; Lenz, 1988; Mace, Page, Ivancic, & O’Brien, 1986; MacPherson, Candee, & Hohman, 1974; Mathews, Friman, Barone, Ross, & Christophersen, 1987; Rolider & Van Houten, 1985; Rortvedt & Miltenberger, 1994). Short time-outs that do not significantly interfere with students’ academic learning are often quite effective (Skiba & Raison, 1990); many psychologists argue that durations of 10 minutes (even as few as 2 minutes for preschool children) are sufficient. A key to using time-out effectively is that the inappropriate behavior must stop before the child is released from the time-out situation; release from time-out (a negative reinforcer) is therefore contingent on appropriate behavior.

Response Cost

Response cost involves the withdrawal of a previously earned reinforcer, a ticket for speed-ing (resulting in the payment of a fine) and the loss of previously earned privileges are examples. Response cost has been shown to reduce such misbehaviors as aggression, inappropriate speech, disruptiveness, hyperactivity, and tardiness (Iwata & Bailey, 1974; Kazdin, 1972; McLaughlin & Malaby, 1972; Rapport, Murphy, & Bailey, 1982) and appears...
to be particularly effective when combined with reinforcement of appropriate behavior (Phillips, Phillips, Fixsen, & Wolf, 1971).

**Verbal Reprimand**

Although some students find teacher attention of any kind to be reinforcing, most probably regard a verbal reprimand—a scolding or admonishment—as punishment (O’Leary, Kaufman, Kass, & Drabman, 1970; Van Houten, Nau, MacKenzie-Keating, Samesot, & Colavecchia, 1982). In addition to suppressing undesirable behavior, occasional reprimands also appear to enhance the positive reinforcement value of praise (Palfiener & O’Leary, 1987).

Reprimands are often more effective when they are accompanied by eye contact (e.g., The Look) or a firm grip (Van Houten et al., 1982). They may also be more effective when spoken quietly and in close proximity to the child being punished (O’Leary et al., 1970; Van Houten et al., 1982). Such unobtrusive reprimands are less likely to attract the (potentially reinforcing) attention of other individuals in the room.

**Restitution and Overcorrection**

Restitution and overcorrection involve requiring people to take actions that correct the results of their misdeeds. In restitution, a misbehaving individual must return the environment to the same state of affairs it was in before the misbehavior. As examples, a child who breaks a window must pay for a new one, and a child who makes a mess must clean it up. Restitution is a good example of a logical consequence, whereby the punishment fits the crime.

In the case of restitutional overcorrection, the punished individual must make things better than they were before the inappropriate behavior (Foxx & Azrin, 1973; Foxx & Bechtel, 1985; Rusch & Close, 1976). For example, a student who throws food in the lunchroom might be asked to mop the entire lunchroom floor, or the student who offends a classmate might be asked to apologize to the entire class.

Positive-practice overcorrection involves having an individual repeat an action, but this time doing it correctly, perhaps in an exaggerated fashion. For example, a student who runs dangerously down the school corridor might be asked to back up and then walk (perhaps at a normal pace, or perhaps very slowly) down the hall. Similarly, a student in a drivers’ education class who neglects to stop at a stop sign might be asked to drive around the block, return to the same intersection, and come to a complete stop (perhaps counting aloud to five) before proceeding.

Practitioners have mixed views regarding the value of restitutional overcorrection and positive-practice overcorrection as methods of bringing about behavior improvement in school settings; in some cases, these techniques may be overly time-consuming and draw unnecessary attention to the punished behavior (Schloss & Smith, 1994; Zirpoli & Melloy, 1993). When such approaches are used, however, teachers should portray them more as means for helping students acquire appropriate behavior than as punishment per se (Alberto & Troutman, 1990; Carey & Bucher, 1986; Zirpoli & Melloy, 1993).

The punishments I’ve just described appear to have fewer negative side effects than either physical punishment (e.g., spanking) or psychological punishment (e.g., withdrawal of love) (Walters & Grusec, 1977). Yet teachers who use recommended forms of punishment to reduce inappropriate behavior must nevertheless monitor their effects on the behaviors being punished. For example, some individuals find time-out to be reinforcing rather than punishing (Alberto & Troutman, 1990; Solnick, Rincove, & Peterson, 1977), and thus their ‘punished’ behaviors will increase rather than diminish.

Earlier I discussed the importance of reinforcement as a means of providing feedback about what constitutes appropriate behavior. In much the same way, punishment is probably effective to the extent that it gives feedback about inappropriate behavior. Sometimes students are truly unaware of how frequently they misbehave (e.g., Krumboltz & Krumboltz, 1972), and the occasional punishment of inappropriate responses can provide reminders
that keep these students on task. But how do we avoid such negative side effects as aggres-
sion, escape responses, and negative emotional reactions? Let’s turn to some guidelines for
using punishment in the classroom.

Guidelines for Using Punishment Effectively

Psychologists and educators have offered numerous suggestions on how to use punishment
effectively, many of which decrease the chances of negative side effects. The guidelines
that follow are among those most commonly cited:

• The “punishment” must be punishing. Punishment, like reinforcement, is defined by its
effect on behavior. True punishment decreases the response it follows. If a given conse-
quence does not decrease the response it is meant to punish, that consequence may not
be aversive to the individual being “punished”; in fact, it may even be reinforcing.

Teachers and parents too often make assumptions about what consequences will be
punishing for children. For example, a common “punishment” around our house is to be sent
to one’s room. For my two sons, such a consequence is truly aversive, because they would
much rather socialize with the family in the kitchen or living room than be isolated in
their rooms for any length of time. But when my daughter Tina is banished to her bed-
room, she is probably being reinforced: She rearranges her furniture, listens to her radio, or
settles under the covers with a good book. And the behaviors for which she has been most
often punished in this way—behaviors related in one way or another to annoying and teas-
ing her brothers—seem to have increased rather than decreased.

• The punishment must be strong enough to be effective but not overly severe.

Pun-
ishment that is too short or mild is not effective (e.g., Parke & Walters, 1967). For example,
fines for such behaviors as speeding and drunken driving are obviously insufficient deter-
rants for some individuals. Similarly, grades in many college classrooms may be too lenient
to discourage a student from academically unproductive behaviors. A college teacher may
believe that by giving some students a C, she is punishing those students for their lack of
class attendance and poor exam performance. Yet a C average is quite acceptable at most
institutions, so the students may not be sufficiently “punished” to reduce their frequency of
party-going and Frisbee throwing at times when they should be attending classes or read-
ing their textbooks.

At the same time, punishment must not be overly severe, or it might lead to such unde-
sirable side effects as resentment, hostility, aggression, or escape behavior. Furthermore,
although severe punishment may quickly suppress a response, that response may reappear
at its original level once the punisher has left the scene (Appel & Peterson, 1965; Azrin,
1960). The ultimate purpose of administering punishment is to communicate that the lim-
its of acceptable behavior have been exceeded; it should not be so excessive that it under-
mines the personal relationship between the punisher and the person being punished
(Spaulding, 1992).

• Punishment should be threatened once before it is administered. (My use of the term
threaten here means only that people should be warned ahead of time, not that they
should be intimidated.) Punishment is most likely to deter behavior when an individual
knows that the behavior will lead to punishment (e.g., Aronfreed, 1968). Therefore, peo-
ple should know ahead of time that a particular behavior will be punished and what the
punishment will be: I remember an incident, when I was about four years old, in which I
was punished without warning. Sitting at lunch one day, apparently considering the old
adage “Waste not, want not,” I proceeded to lick a large quantity of peanut butter off my
butter knife. An adult scolded me sternly for my behavior, and I was devastated. Being the
Miss Goody Two-shoes that I was at the time, I would never have engaged in knife-licking
behavior if I had known it was an unacceptable response.

One common mistake many teachers and parents make is to continue to threaten pun-
ishment without ever following through. One threat is advisable, but repeated threats are
not. The mother who continually says to her son, "If you hit your sister again, Tommy, I’ll send you to your room for the rest of the week," but never does send Tommy to his room, is giving her son the message that no response-punishment contingency really exists.

One of the reasons that teachers and parents often fail to follow through with threatened punishment is that they too often bluff, proposing punishment that is impractical or unrealistically extreme. Tommy’s mother does not punish her son because forcing Tommy to spend "the rest of the week" in his room would be a major inconvenience for both of them. A teacher who threatens that certain behaviors will result in students not going on a promised field trip should do so only if he or she knows that leaving some students behind at school is logistically possible.

- **The behavior to be punished should be described in clear, concrete terms.** Students should understand exactly which responses are unacceptable. A student who is told, "If you disrupt the class again this morning, you will lose your free time," may not understand exactly what the teacher means by "disrupt" and so may continue to engage in inappropriate classroom behavior. The teacher should instead take the student aside and say something like this: "Sharon, two behaviors are unacceptable in this classroom. When you talk without permission and when you get out of your seat during quiet reading time, you keep other children from getting their work done. This morning I expect you to talk and get out of your seat only when I give you permission to do so. Otherwise, you will have to sit quietly at your desk this afternoon when the other children have their free time."

- **Punishment should be consistent.** Just as is true for reinforcement, punishment is much more effective when it is a consistent consequence of a particular response (Leff, 1969; Parke & Deur, 1972; Rachlin, 1991). When a response is punished only occasionally, with other occurrences of that response being either reinforced or ignored, the response disappears slowly, if at all. Consistent with this principle is the fact that many juvenile delinquents come from home environments in which parental discipline has been administered inconsistently (Glueck & Glueck, 1950; McCord, McCord, & Zola, 1959).

Unfortunately, people can only be punished when they have been caught in the act. Thieves are rarely apprehended, and speeders are ticketed only when the highways on which they drive are patrolled. Many undesirable classroom behaviors, such as talking out, getting out of one’s seat, being aggressive, and cheating, may be reinforced as frequently as they are punished. To deal with the difficulty of detecting some undesirable student behaviors, the next two guidelines—changing the situation so the misbehavior is less likely to occur and providing a positively reinforceable alternative behavior—are especially critical.

- **Whenever possible, the environment should be modified so that the misbehavior is less likely to occur.** In other words, the temptation to engage in a misbehavior should be reduced or, if possible, eliminated. People on diets should not stock their kitchens with junk food. Troublemaking friends should be placed on opposite sides of the classroom or in separate classrooms. Cheating on an exam can be reduced by having students sit apart from one another or by administering two different forms of the exam (perhaps the same test items in two different orders).

- **Desirable alternative behaviors should be taught and reinforced.** Punishment of misbehavior is typically more effective when it is combined with reinforcement of appropriate behavior (Carey & Bucher, 1986; Rimm & Masters, 1974; Walters & Grusec, 1977). A misbehavior is more likely to be suppressed permanently when alternative behaviors are reinforced, especially when those behaviors are incompatible with the punished behavior. For example, when punishing aggression on the playground, teachers should remember also to reinforce appropriate social behavior. Teachers can punish a student for cheating, but they should also reinforce that student for demonstrating good study habits and for working well independently.

- **Whenever possible, punishment should immediately follow the inappropriate behavior.** As is true for reinforcement, the effectiveness of punishment decreases dramatically when it is delayed (Trenholm & Baron, 1975; Walters, 1964; Walters & Grusec, 1977). The more closely punishment follows a misbehavior, the more effective it will be. Punish-
ment is particularly effective when it is administered as soon as the misbehavior begins (Aronfreed, 1968; Aronfreed & Reber, 1965). When, for whatever reason, punishment cannot be administered immediately, delayed punishment may be effective provided that the punished behavior is clearly described (Aronfreed & Reber, 1965).

- An explanation of why the behavior is unacceptable should be given. Although behaviorists tend to focus their attention on responses and their consequences, a growing body of research indicates that punishment is more effective when reasons why certain behaviors cannot be tolerated are given (Baumrind, 1983; Hess & McDevitt, 1984; Parke, 1972, 1974, 1977; Perry & Perry, 1983). For example, notice how Sharon’s teacher incorporated reasoning into her description of Sharon’s inappropriate behaviors: “When you talk without permission and when you get out of your seat during quiet reading time, you keep other children from getting their work done.”

Providing reasons as to why behaviors are unacceptable has at least four advantages:

1. When punishment is accompanied by reasoning, it appears to make the immediacy of punishment a less critical factor in its effectiveness (Walters & Grusec, 1977).
2. Reasoning increases the likelihood that when one behavior is punished, similar misbehaviors are also suppressed; that is, the effect of the punishment generalizes to other misbehaviors (Walters & Grusec, 1977).
3. If reasons are given, misbehaviors are likely to be suppressed even when the punisher is absent (Walters & Grusec, 1977).
4. Older children apparently expect to be told why they cannot engage in certain behaviors and are likely to be defiant when reasons are not provided (Cheyne & Walters, 1970).

- Some punishments are particularly ineffective and should be avoided. Among the punishments generally not recommended are physical punishment, psychological punishment, extra classwork, and suspension from school.

Physical punishment may be the only means of keeping very young children from engaging in potentially harmful behaviors. For example, the toddler who takes delight in sticking metal objects into electrical outlets must be quickly discouraged from such behavior, and a slap on the hand may be the only way of doing so. However, the use of physical punishment with older children is likely to provide a model of aggression for those children. Consider as evidence the finding that the great majority of abusive parents have been themselves abused as children (Steele & Pollack, 1968; Steinmetz, 1977; Strauss, Gelles, & Steinmetz, 1980).

Psychological punishment, such as embarrassing or insulting a child, also is not recommended (Davis & Thomas, 1989; Walker & Shea, 1995). Children who are consistently made to feel inferior or inadequate are likely to develop low self-esteem, which will interfere with their engaging in appropriate and constructive behaviors on future occasions.

Extra classwork is appropriate when it is a logical consequence of the misbehavior (e.g., when students are failing at academic tasks because of their inattentiveness in class), but in other situations it transmits the message that schoolwork is not fun. When Marcus is punished for his disruptive classroom behaviors by being assigned an additional 100 mathematics problems, he is unlikely to continue to regard mathematics in a positive light.

Finally, suspension from school is typically an ineffective remedy for misbehavior (Doyle, 1990; Moles, 1990). Many chronically misbehaving students are students who have difficulty with their academic work; many high school troublemakers, for example, are students with poor reading skills. Suspending such students from school puts these students at an even greater disadvantage and decreases still further the likelihood of academic success. Additionally, when students find school to be an aversive situation, removal from that environment is negatively reinforcing rather than punishing. (It is also negatively reinforcing to the administrators who have gotten rid of their troublemakers!)

An alternative, more effective punishment for chronic misbehavers is in-house suspension (e.g., see anecdotal reports by DiSciullo, 1984; Huff, 1988; Short & Noblit, 1985).
In-house suspension is similar to a time-out in that punished students are placed in a quiet, boring room within the school building. In-house suspension typically lasts one or more days rather than just a few minutes, however, and students suspended in this manner are continually monitored by a member of the school staff. Students bring their schoolwork with them and must keep up with their classroom assignments. In-house suspension tends to be effective because it does not allow students to escape the school environment yet prevents the social interactions with peers that most students find reinforcing.

Punishment should be used sparingly. The studies by Hall and his colleagues (1971) that I depicted earlier in Figures 2–12, 2–13, and 2–14 provide several illustrations of how quickly punishment can reduce inappropriate behavior. An effective punishment is one that does not need to be administered very often to be effective. Only when punishment is a frequent occurrence (in which case it is obviously not effective anyway) are the numerous disadvantages of punishment likely to appear.

When used properly, punishment is the quickest way of reducing or eliminating unacceptable behaviors. Remember, behaviorists define punishment as a consequence that decreases the response it follows. A “punishment” that clearly is not suppressing an undesirable behavior very quickly should be replaced by a different consequence.

LEARNED HELPLESSNESS

Imagine that you are a student who is continually failing assignments and exams. You try all kinds of strategies to improve your grades—studying longer, memorizing your textbooks word for word, having a friend drill you on key points, and even sleeping with your books open over your head (hoping that the information will sink in)—and still you get F after F after F. Eventually, you would probably just stop trying to achieve academic success and accept the “fact” that you have no control over the grades you receive.

When aversive stimuli are presented repeatedly, and when an organism cannot avoid, escape from, or otherwise terminate them, the organism will eventually give up and passively accept those stimuli. This passive acceptance of uncontrollable aversive events is a phenomenon known as learned helplessness.

Let me illustrate the phenomenon by describing research conducted by Seligman and Maier (1967). In the first phase of this classic experiment, dogs received numerous painful and unpredictable shocks. Some dogs were able to escape the shocks by pushing a panel in the cage, whereas other dogs could not escape the shocks regardless of what they did. The following day, each dog was placed in a box divided into two compartments by a barrier. While in this box, the dog was presented with a series of tone-shock combinations, with a tone always preceding a shock; the dog could avoid the shock by jumping over the barrier into the other compartment as soon as it heard the tone. Dogs that had been able to escape the shocks on the previous day quickly learned to escape the shocks on the second day. In contrast, dogs that previously had been unable to escape displayed learned helplessness: They made few attempts to escape, instead simply sitting still and whining as the shocks were presented.

People, too, begin to exhibit symptoms of learned helplessness when they cannot control the occurrence of aversive events (Hiroto, 1974; Hiroto & Seligman, 1975; Peterson, Maier, & Seligman, 1993). According to Maier and Seligman (1976), learned helplessness is manifested in three ways: First, there is a motivational effect: The individual is slow to exhibit responses that will yield reinforcement or allow escape from punishment. Second is a cognitive effect: The individual has difficulty learning in future situations in which control of consequences is possible. Even when the individual’s responses lead to reinforcement or escape from an aversive stimulus, the individual tends not to learn from those experiences. The third effect is an emotional one: The individual tends to be passive, withdrawn, fearful, and depressed.
Learned helplessness has been offered as an explanation of clinical depression (Seligman, 1975, 1991): Depressed people typically perceive that they have less control over their lives than nondepressed people. It may also be characteristic of some school children, particularly those who experience consistent difficulty completing academic tasks (Dweck, 1986; Eccles & Wigfield, 1985; Fennema, 1987; Holliday, 1985; Jacobsen, Lowery, & DaCetse, 1986; Stipek & Kowalski, 1989; Wood, Schau, & Fiedler, 1990). Consider the child with a learning disability as an example. Often unidentified as a student with special educational needs, the child may encounter repeated failure in academic work, despite reasonable efforts to succeed, and so may eventually stop trying. I have also seen the learned helplessness phenomenon in presumably nondisabled students when I talk with them about certain subject areas. Many students, for example, attribute their mathematics anxiety to the fact that, as elementary school students, they could not comprehend how to solve certain problems no matter what they did or how hard they tried. Others show learned helplessness in the area of spelling: Even when they know they have spelled a word incorrectly, they do not try to correct the spelling, excusing their behavior by such statements as “I’m just a bad speller” or “I never could spell very well” (Ormrod & Wagner, 1987).

Learned helplessness is clearly a situation in which aversive consequences occur unpredictably rather than being contingent on certain behaviors. Ultimately, individuals experiencing such seemingly random consequences may begin to believe, perhaps justifiably, that they have little or no control over the things that happen to them. We will look in more detail at the effects of perceived control (or lack thereof) as we discuss the cognitive side of learned helplessness.

With this section, we have seen how response-reinforcement contingencies increase certain responses and how response-punishment contingencies decrease others. To succeed in the school environment, students must be aware of those contingencies and be able to exhibit the responses that lead to positive outcomes. When students are unable to learn despite clearly specified contingencies and a slow, carefully designed curricular sequence, they may have cognitive problems that teachers cannot address from a strictly behaviorist perspective. In such situations, cognitive learning theories may provide a more useful framework.

We will make a gradual transition to the study of cognition in the next section. There we will look at social learning theory, a theory that originated within the behaviorist perspective (especially operant conditioning) but has more recently begun to use cognitive ideas in its explanation of human behavior.

SUMMARY

Escape learning is the process of learning to terminate an aversive stimulus. Avoidance learning is the process of learning to avoid an aversive stimulus altogether. Unfortunately, when organisms avoid a particular situation, they never have the opportunity to discover when the situation is no longer aversive; hence, avoidance responses, once learned, are difficult to extinguish.

Views on punishment have changed considerably over the past 60 years. Early researchers found that punishment did little to reduce behaviors and cited numerous disadvantages of its use. More recently, however, some forms of punishment (e.g., time-outs, response cost, and reprimands) have been found to be effective in decreasing a variety of inappropriate behaviors. A number of guidelines in the use of punishment promote its effectiveness.

When aversive stimuli are repeatedly presented regardless of how a person behaves, he or she may develop a sense of learned helplessness—a sense of having little control over the environment—with motivational, cognitive, and emotional side effects.
The evil eye may remind you of The Look described in the earlier discussion of classical conditioning. Although some stimuli (e.g., those that cause physical pain) are naturally aversive, others (e.g., certain facial expressions) may become aversive over time through their association with other unpleasant stimuli—in other words, through classical conditioning.
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