



## Key Question Chapter Outline

### What Sort of Learning Does Classical Conditioning Explain?

The Essentials of Classical Conditioning  
Applications of Classical Conditioning

### How Do We Learn New Behaviors by Operant Conditioning?

Skinner's Radical Behaviorism  
The Power of Reinforcement  
The Problem of Punishment  
Operant and Classical Conditioning Compared

### How Does Cognitive Psychology Explain Learning?

Insight Learning: Köhler in the Canaries with the Chimps  
Cognitive Maps: Tolman Finds Out What's on a Rat's Mind  
Observational Learning: Bandura's Challenge to Behaviorism  
Rethinking Behavioral Learning in Cognitive Terms  
Brain Mechanisms and Learning  
"Higher" Cognitive Learning

Learning: The State of the Art



## CORE CONCEPTS



Classical conditioning is a basic form of learning in which a stimulus that produces an innate reflex becomes associated with a previously neutral stimulus, which then acquires the power to elicit essentially the same response.



In operant conditioning, the consequences of behavior, such as rewards and punishments, influence the chance that the behavior will occur again.



According to cognitive psychology, some forms of learning must be explained as changes in mental processes, rather than as changes in behavior alone.



## Psychology in Your Life

### Taste Aversions and Chemotherapy

Your friend risks developing a food aversion when the medicine makes her feel sick.

### A Checklist for Modifying Operant Behavior

For changing your own behavior or someone else's, a combination of reinforcement and extinction is usually the best bet.

### A Critical Look at "Learning Styles"

Many claims are made for different learning styles, but the evidence supporting them is weak.

**USING PSYCHOLOGY TO LEARN PSYCHOLOGY:**  
Operant Conditioning Can Help You Study More—and Enjoy It

# Learning

**S**ABRA HAD JUST GRADUATED from college, with a degree in graphic arts, and landed a good job at an advertising firm in San Francisco. The work was interesting and challenging, and Sabra enjoyed her new colleagues. The only negative was that her supervisor had asked her to attend an upcoming conference in Hawaii—and take an extra few days of vacation there at the company’s expense. The problem was Sabra’s fear of flying.

She hadn’t had to deal with her fear previously because there was always an alternative. All her life, Sabra had lived close enough to family members that she could easily drive to visit them. And when she went away to college, it was only a 300-mile journey, so she could drive or take the train. But there was no other way to get to Hawaii (except by boat—which would be much too slow for commuting to a business conference). What was she to do?

A friend mentioned having seen an article in the newspaper about a program initiated by one of the airlines to help people overcome their fear of flying. Fortunately, Sabra had a few weeks before the conference started, so she contacted the airline and signed up for three weekend treatment sessions to be held at a local airport.

Sabra arrived at the appointed time, full of expectations and apprehensions—most of which turned out to be wrong. Would she have to see a therapist who would probe her childhood experiences and fantasies? Would they prescribe tranquilizers? Or would they give her some sort of terror-inducing treatment, such as flying upside-down in a small airplane?



In fact, the sessions were organized by a behavioral psychologist who gathered the nine participants in a small conference room. The therapist began by saying that such fears are learned—much as you might learn to cringe when you hear a dentist’s drill or the scraping of fingernails on a blackboard. She said that it was not important how such fears got started. This fear-of-flying program would focus on the present, not on the past. Sabra began to feel more relaxed.

After a brief description of the learning-based therapy to be used, the group took a tour of the airport, including the cabin of a passenger jet parked on the Tarmac. Then they went back to “class” to learn the basics of how airplanes work and the physical forces that keep them in the air. The group also watched some videos involving routine flights in a commercial airplane. All in all, this first session went smoothly, and everyone seemed much more at ease than when they started.

The second weekend began with more classroom discussion. Then, the class went back into the airliner, where they took seats and went through a series of relaxation exercises led by the therapist. This training included deep breathing and progressive relaxation of specific muscle groups all over the body. When everyone in the group reported feeling relaxed, they again watched videos of flight on the plane’s TV monitors. This was followed by more relaxation exercises. The final activity for the second weekend involved starting the engines and going through the preflight routine—all the way up to takeoff . . . and more relaxation exercises.

The final weekend session was almost identical to the previous one. The only difference was that the “graduation” exercise was an actual flight—a 20-minute trip out over the local countryside and back to the airport. It was, of course, voluntary, but only one of the nine people in the class chose not to go. Sabra went, but not without some anxiety. The therapist, however, encouraged the group to focus on the relaxation exercises they had learned, rather than on their feelings of fear. To the amazement of all who participated, these learning-based techniques helped them through the flight exercise without losing control of their emotional responses. Although no one’s fear had vanished completely, everyone was able to bring it under control.

The happiest result was that Sabra was able to go to her meeting in Hawaii—where, by the way, she had a productive conference and a wonderful time. For our purposes we should also note that Sabra has flown several times since then, and she reports that each trip gets just a little easier—just as the psychology of learning would predict.

**A Definition of Learning** The program that saved Sabra’s job came out of research in *learning*—but not the sort of hit-the-books learning that usually comes to the minds of college students. Psychologists define **learning** broadly, as a process through which experience produces a lasting change in behavior or mental processes. According to this definition, then, Sabra’s “flight training” was learning—just as much as taking golf lessons and reading this book are learning experiences.

To avoid confusion, two parts of our definition need some elaboration. First, we should underscore the idea that learning leads to a *lasting change* in behavior. Suppose that you go to your doctor’s office and get a particularly unpleasant injection, during which the sight of the needle becomes associated with pain. As a result, the next time you need a shot, you wince when you first see the needle. This persistent change in responding involves learning. But, by the same standard, a simple, reflexive reaction, such as jumping when you hear an unexpected loud noise, does *not* qualify as learning because it produces no

■ **Learning** A lasting change in behavior or mental processes that results from experience.

lasting change—nothing more than a fleeting reaction, even though it does entail a change in behavior.

Second, we should elaborate on the part of the definition that says learning affects *behavior* or *mental processes*. In the doctor's office example above, it is easy to see how learning affects behavior. But mental processes are more difficult to observe. How could you tell, for example, whether a laboratory rat had simply learned the behaviors required to negotiate a maze (turn right, then left, then right . . .) or whether it was following some sort of mental image of the maze, much as you would follow a road map? (And why should we care what, if anything, was on a rat's mind?)

**Behavioral Learning versus Cognitive Learning** The problem of observing mental events, whether in rats or in people, underlies a long-running controversy between the behaviorists and the cognitive psychologists that threads through this chapter. For over 100 years, the behaviorists have maintained that psychology could be a true science only if it disregarded mental processes and focused exclusively on objective, observable stimuli and responses. On the other side of the issue, cognitive psychologists have contended that the behavioral view is far too limiting and that understanding learning requires that we make inferences about hidden mental processes. In the following pages, we will see that both sides in this dispute have made important contributions to our knowledge.

**Learning versus Instincts** So, what does learning—either behavioral or cognitive learning—do for us? Nearly every human activity, from working to playing to interacting with family and friends, involves some form of learning. Without learning, we would have no human language. We wouldn't know who our family or friends were. We would have no memory of our past or goals for our future. And without learning, we would be forced to rely on simple reflexes and a limited repertoire of innate behaviors, sometimes known as "instincts."

In contrast with learned responses, instinctive behavior (more properly known as *species-typical behavior*) is heavily influenced by genetic programming. It occurs in essentially the same way across different individuals in a species. We see instincts at work in bird migrations, animal courtship rituals, and a few human behavior patterns, such as nursing in newborns. All these examples involve responses that are influenced relatively little by experience, as compared to learned behaviors such as operating a computer, playing tennis, or wincing at the sight of a needle. In general, human behavior is much more influenced by learning and much less influenced by instincts than that of other animals. For us, learning confers the flexibility to adapt quickly to changing situations and new environments. In this sense, then, learning represents an evolutionary advance over instincts.

**Simple and Complex Forms of Learning** Some forms of learning can be quite simple. For example, if you live near a busy street, you may learn to ignore the sound of the traffic. This sort of learning, known as **habituation**, involves learning *not to respond* to stimulation. It occurs in all animals that have nervous systems, including insects and worms. Another relatively simple form of learning is seen most obviously in humans: a preference for stimuli to which we have been previously exposed—whether or not the stimulus was associated with something pleasurable or even whether we were aware of the stimulus. This **mere exposure effect** probably accounts for the effectiveness of much advertising (Terry, 2000; Zajonc, 1968, 2001).

Other kinds of learning can be more complex. One involves learning a connection between two stimuli—as when a school child associates the 12 o'clock



● Aversive conditioning has occurred when the mere sight of an object, such as a hypodermic needle, causes an avoidance reaction.

#### CONNECTION: CHAPTER 8

*Instinct* refers to motivated behaviors that have a strong innate basis.

■ **Habituation** Learning not to respond to the repeated presentation of a stimulus.

■ **Mere exposure effect** A learned preference for stimuli to which we have been previously exposed.



bell with lunch. And another occurs when we associate our actions with rewarding and punishing consequences, such as praise or a reprimand from the boss or an A or a D from a professor. The first two sections of the chapter will deal with these two types of **behavioral learning**, which we will call *classical conditioning* and *operant conditioning*.

In the third section of the chapter, the focus shifts from external behavior to internal mental processes. Our look at *cognitive learning* will consider how sudden “flashes” of insight and the imitative behavior require theories that go beyond behavioral learning—to explain how we solve puzzles or why children copy behavior they see on TV. We will also discuss the most complex type of learning, which involves the acquisition of concepts, the sort of learning you do in your college classes. Finally, the chapter will close on a practical note, by considering how to use the psychology of learning to help you study more effectively—and enjoy it. We begin, however, with a form of behavioral learning that accounts for many of your likes and dislikes—and, for one of your authors, an extreme dislike of olives.



## WHAT SORT OF LEARNING DOES CLASSICAL CONDITIONING EXPLAIN?

### CONNECTION: CHAPTER 1

*Structuralism and functionalism* were two of the earliest schools of psychology.

Ivan Pavlov (1849–1936) would have been insulted if you had called him a psychologist. In fact, he had only contempt for the structuralist and functionalist psychology of his time, which he saw as being hopelessly mired in speculation about subjective mental life (Todes, 1997). Pavlov and the hundreds of student researchers who passed through Pavlov’s Russian research “factory” were famous for their work on the digestive system, for which Pavlov eventually snared a Nobel prize (Fancher, 1979; Kimble, 1991).

Unexpectedly, however, the experiments on salivation (the first step in digestion) went awry, sending Pavlov and his crew on a detour into the psychology of learning—a detour that occupied Pavlov for the rest of his life. The problem was that the experimental animals began salivating even *before* food was put in their mouths (Dewsbury, 1997). In fact, saliva would start flowing when they saw the food or even when they heard the footsteps of the lab assistant bringing the food.

This response was a puzzle. What, after all, was the biological function of salivating in anticipation of food? When Pavlov and his associates turned their attention to understanding these “psychic secretions,” they made a series

■ **Behavioral learning** Forms of learning, such as classical conditioning and operant conditioning, that can be described in terms of stimuli and responses.

● To study classical conditioning, Pavlov placed his dogs in a restraining apparatus. The dogs were then presented with a neutral stimulus, such as a tone. Through its association with food, the neutral stimulus became a conditioned stimulus eliciting salivation.



of discoveries that would change the course of psychology (Pavlov, 1928; Todes, 1997). Quite by accident, they had stumbled upon an objective model of *learning*—one that could be manipulated in the laboratory to tease out the learned connections among stimuli and responses. This discovery, now known as **classical conditioning**, forms the Core Concept of this section:

Classical conditioning is a basic form of learning in which a stimulus that produces an innate reflex becomes associated with a previously neutral stimulus, which then acquires the power to elicit essentially the same response.



In the following pages we will see that classical conditioning accounts for some important behavior patterns found not only in animals but also in people. By means of classical conditioning, organisms learn about cues that help them avoid danger, as well as cues alerting them to food, sexual opportunity, and other conditions that promote survival. First, however, let's examine some of the fundamental features that Pavlov identified in classical conditioning.

## The Essentials of Classical Conditioning

It is important to note that Pavlov's work on learning focused on simple, automatic responses known as *reflexes* (Windholz, 1997). Salivation and eye blinks are examples of such reflexes: They are normally triggered by stimuli that have biological significance. The blinking reflex, for example, protects the eyes; the salivation reflex aids digestion.

Pavlov's great discovery was that these reflexive responses could be associated with new stimuli—neutral stimuli that had previously produced no response. Thus, the connection between a reflex and a new stimulus could be *learned*. For example, Pavlov found he could teach his dogs to salivate upon hearing a certain sound, such as the tone produced by a tuning fork or a bell. You have experienced the same sort of learning if your mouth waters when you see a chocolate brownie.

To understand how these “conditioned reflexes” worked, Pavlov's team employed a simple experimental strategy. They first placed an untrained dog in a harness and set up a vial to capture the animal's saliva. Then, at intervals, a tone was sounded, after which the dog was given a bit of food. Gradually, over a number of trials, the dog began to salivate in response to the tone alone. In general, Pavlov and his students found that a **neutral stimulus** (one without any reflex-provoking power, such as a tone or a light), when paired with a natural reflex-producing stimulus (food), will by itself begin to elicit a learned response (salivation) that is similar to the original reflex. It's essentially the same conditioning process behind the association of romance with flowers or chocolate.

The main features of Pavlov's classical conditioning procedure are illustrated in Figure 6.1. At first glance, the terms may seem a bit overwhelming. Nevertheless, you will find it immensely helpful to study them carefully now so that they will come to mind easily later, when we analyze complicated, real-life learning situations, such as the acquisition and treatment of fears, phobias, and food aversions. Here we go . . .

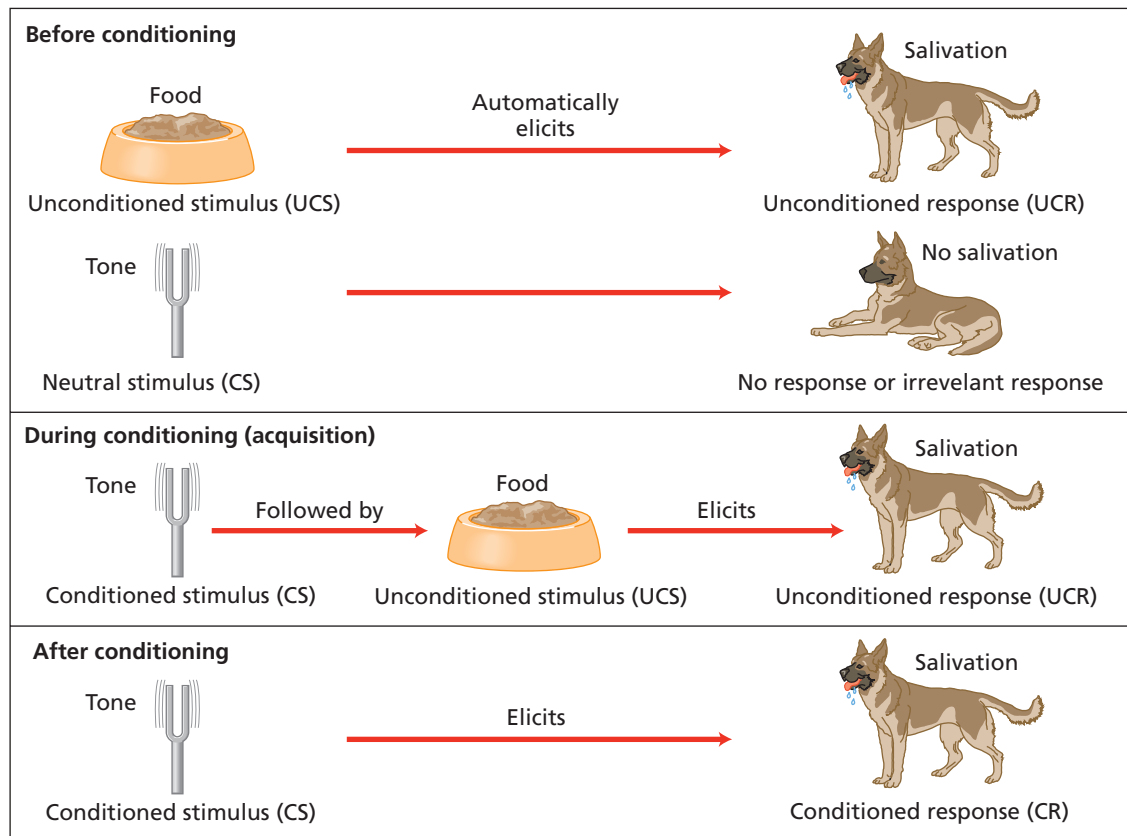
**Acquisition** Classical conditioning always involves an **unconditioned stimulus (UCS)**, a stimulus that automatically—that is, without conditioning—provokes a reflexive response. In Pavlov's experiments, food was used as the UCS because it produced a salivation reflex. In the language of classical conditioning, then, this response is called an *unconditioned reflex* or, more commonly, an **unconditioned response (UCR)**. It is important to realize that the UCS–UCR connection involves no learning.

■ **Classical conditioning** A form of behavioral learning in which a previously neutral stimulus acquires the power to elicit the same innate reflex produced by another stimulus.

■ **Neutral stimulus** Any stimulus that produces no conditioned response prior to learning. When it is brought into a conditioning experiment, the researcher will call it a conditioned stimulus (CS). The assumption is that some conditioning occurs after even one pairing of the CS and UCS.

■ **Unconditioned stimulus (UCS)** In classical conditioning, the stimulus that elicits an unconditioned response.

■ **Unconditioned response (UCR)** In classical conditioning, the response elicited by an unconditioned stimulus without prior learning.



● **FIGURE 6.1** Basic Features of Classical Conditioning

Before conditioning, the food (UCS) naturally elicits salivation (UCR). A tone from a tuning fork is a neutral stimulus and has no effect. During conditioning (the acquisition phase), the tone is paired with the food, which continues to elicit the salivation response. Through its association with the food, the previously neutral tone becomes a conditioned stimulus (CS), gradually producing a stronger and stronger salivation response. (Source: From *PSYCHOLOGY AND LIFE* 15th ed. by P. G. Zimbardo and R. J. Gerrig. Copyright © 1999 by Pearson Education. Published and reprinted by permission of Allyn & Bacon, Boston, MA.)

During the **acquisition** or initial learning stage of classical conditioning, a neutral stimulus (a tone, for example) is paired with the unconditioned stimulus. Typically, after several trials the neutral stimulus will gradually come to elicit essentially the same response as does the UCS. So, in Pavlov's experiment in which the tone produced salivation, we say that this formerly neutral stimulus has become a **conditioned stimulus (CS)**. Although the response to the conditioned stimulus is essentially the same as the response originally produced by the unconditioned stimulus, we now refer to it as the **conditioned response (CR)**.

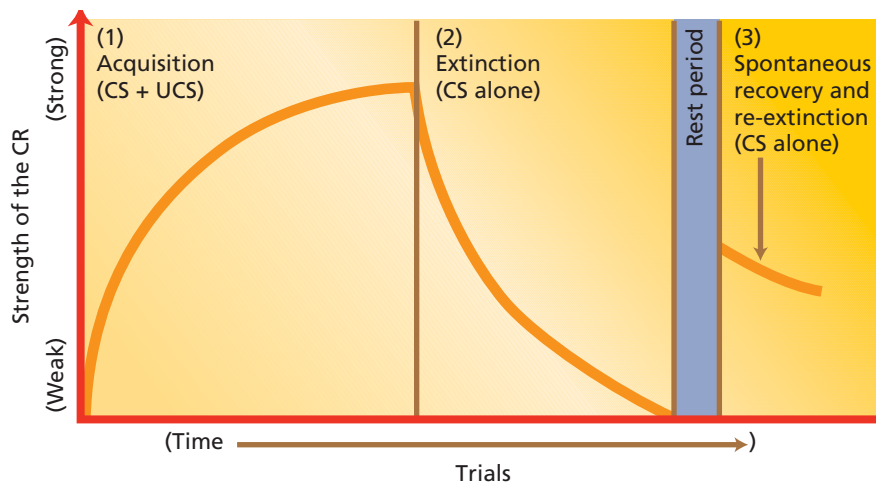
With those terms firmly in mind, look at the graph of acquisition in a typical classical conditioning experiment, which appears in the first panel of Figure 6.2, where gradual acquisition of the conditioned response is reflected in the upward sweep of the line. Note that, at first, only weak responses are elicited by the conditioned stimulus. With continued CS–UCS pairings, however, the conditioned response increases in strength.

In conditioning, as in telling a joke, timing is critical. In most cases, the CS and UCS must be presented *contiguously* (close together in time) so that the organism can make the appropriate connection. The range of time intervals between the CS and UCS that will produce the best conditioning depends on the response being conditioned. For motor responses, such as eye blinks, a short interval of a second or less is best. For visceral responses, such as heart rate and salivation, longer intervals of 5 to 15 seconds work best. Conditioned

■ **Acquisition** The initial learning stage in classical conditioning, during which the conditioned response comes to be elicited by the conditioned stimulus.

■ **Conditioned stimulus (CS)** In classical conditioning, a previously neutral stimulus that comes to elicit the conditioned response. Customarily, in a conditioning experiment, the neutral stimulus is called a conditioned stimulus when it is first paired with an unconditioned stimulus (UCS).

■ **Conditioned response (CR)** In classical conditioning, a response elicited by a previously neutral stimulus that has become associated with the unconditioned stimulus.



● **FIGURE 6.2** Acquisition, Extinction, and Spontaneous Recovery

During acquisition (CS + UCS), the strength of the CR increases rapidly. During extinction, when the UCS no longer follows the CS, the strength of the CR drops to zero. The CR may reappear after a brief rest period, even when the UCS is still not presented; only the CS alone appears. The reappearance of the CR is called “spontaneous recovery.” (Source: From PSYCHOLOGY AND LIFE 15th ed. by P. G. Zimbardo and R. J. Gerrig. Copyright © 1999 by Pearson Education. Published and reprinted by permission of Allyn & Bacon, Boston, MA.)

fear optimally requires longer intervals of many seconds or even minutes to develop. Taste aversions, we will see, can develop after even longer delays.

These, then, are the building blocks of classical conditioning: the CS, UCS, CR, UCR, and the timing that connects them. So, why did it take Pavlov three decades and 532 experiments to study such a simple phenomenon? There was more to classical conditioning than first met Pavlov’s eyes. Along with acquisition, he also discovered the processes of *extinction*, *spontaneous recovery*, *generalization*, and *discrimination*—which we will now explore.

**Extinction and Spontaneous Recovery** Suppose that, as a result of classical conditioning, your mouth waters at the sound of a bell on the ice cream wagon that cruises your neighborhood. Does such a conditioned response remain permanently in your behavioral repertoire? The good news, based on experiments by Pavlov’s group, suggests that it does not. Conditioned salivation responses in Pavlov’s dogs were easily eliminated by withholding the UCS (food) over several trials in which the CS (the tone) was presented alone. In the language of classical conditioning this is called **extinction**. It occurs when a conditioned response is eliminated by repeated presentations of the CS without the UCS. Figure 6.2 shows how the conditioned response (salivation) becomes weaker and weaker during extinction trials.

Now for the bad news: Let’s imagine that your mouth-watering conditioned response has been extinguished. (The wagon repeatedly runs out of ice cream just before it gets to your house.) But after a time (the driver has been on a week’s vacation), when you again hear the bell on the ice cream wagon, the conditioned response may reappear *spontaneously*. The same thing happened in Pavlov’s dogs, which began salivating again when they again heard a bell, some time after undergoing extinction training. Pavlov termed this **spontaneous recovery**. Happily, when spontaneous recovery occurs, the conditioned response nearly always reappears at a lower intensity, as you can see in Figure 6.2. In practice, then, the CR can be brought under control, although sometimes this may require several extinction sessions.

The occurrence of spontaneous recovery is of considerable importance in behavior modification therapy for fears. But spontaneous recovery has theoretical importance, too. It tells us that extinction does not involve a complete elimination of the response from the organism’s behavioral repertoire. Rather, extinction merely suppresses the conditioned response. What actually seems to be happening during extinction is the learning of a competing response *not to respond* to the conditioned stimulus.

■ **Extinction (in classical conditioning)** The weakening of a conditioned response in the absence of an unconditioned stimulus.

■ **Spontaneous recovery** The reappearance of an extinguished conditioned response after a time delay.

#### CONNECTION: CHAPTER 13

Behavior modification therapies are based on classical conditioning and operant conditioning.



**Generalization** If you fear spiders, you will probably respond the same way to spiders of all sizes and markings. This is called **stimulus generalization**, a process that involves giving a conditioned response to stimuli that are similar to the CS. Pavlov demonstrated stimulus generalization in his laboratory by showing that a well-trained dog would salivate in response to a bell that made a slightly different sound from the one he had used during conditioning. As you would expect, the closer the sound of the new bell was to the original, the stronger the response.

In everyday life, stimulus generalization is common in people who have acquired fears as a result of traumatic events. Accordingly, a person who has been bitten by a dog may develop a fear of dogs in general, rather than a fear only of the dog responsible for the attack. Likewise, stimulus generalization accounts for an allergy sufferer's sneeze upon seeing a paper flower. In short, by means of stimulus generalization we learn to apply old reflexes in new situations.

**Discrimination Learning** Although you may have learned to salivate at the sound of the bell on the ice cream wagon, you probably don't drool when the doorbell rings—thanks to *stimulus discrimination*. Much the opposite of stimulus generalization, **stimulus discrimination** occurs when an organism learns to respond to one stimulus but not to stimuli that are similar. Pavlov and his students demonstrated this experimentally when they taught dogs to distinguish between two tones of different frequencies. Once again, their procedure was simple: One tone was followed by food, while another was not. Over a series of trials, the dogs gradually learned the discrimination, evidenced in salivation elicited by one tone and not by the other. Beyond the laboratory, discrimination learning can be found in our preferences for one commercial brand over another. Most obviously, perhaps, discrimination is involved in the continuing advertising battle between Pepsi and Coke.

**Conditioning an Experimental Neurosis** If you have ever had a class in which you couldn't guess what the teacher wanted, you have faced a vexing problem in discrimination learning. To study this problem in the laboratory, Pavlov confronted dogs with the seemingly simple task of distinguishing between a circle and an ellipse. One stimulus was always paired with food and the other was always paired with a painful electric shock. The task became more difficult, however, over a series of trials, when Pavlov gradually changed the ellipse to become more and more circular. And how did the dogs respond? As the discrimination became increasingly difficult, their responses grew more erratic. Finally, as the animals became more confused between the circle and the ellipse, they would snarl and snap at the handlers. Because such agitated responses resemble behavior of "neurotic" people who become irritable and defensive when they have difficult choices to make, this behavior pattern was dubbed **experimental neurosis**. Even today, this pattern stands as a model for the deterioration of behavior seen in both people and animals under stress.

## Applications of Classical Conditioning

The beauty of classical conditioning is that it offers a simple explanation for many behaviors, from cravings to aversions. But it offers more than an explanation: It also gives us the tools for eliminating unwanted human behaviors—although Pavlov never attempted any therapeutic applications. It fell to the American behaviorist John Watson to first apply classical conditioning techniques to people.

**The Notorious Case of Little Albert** Conditioned fear in humans was first demonstrated experimentally by John Watson and Rosalie Rayner over 80

### ■ Stimulus generalization

The extension of a learned response to stimuli that are similar to the conditioned stimulus.

■ **Stimulus discrimination** A change in responses to one stimulus but not to stimuli that are similar.

■ **Experimental neurosis** A pattern of erratic behavior resulting from a demanding discrimination learning task, typically one that involves aversive stimuli.

years ago (Brewer, 1991; Fancher, 1979). In an experiment that would be considered unethical today, Watson and Rayner (1920/2000) conditioned an infant named Albert to react fearfully to a white laboratory rat. They created the fear by repeatedly presenting the rat paired with an aversive UCS—the loud sound of a steel bar struck with a mallet. It took only seven trials for “Little Albert” to react with fear at the appearance of the rat (CS) alone. After Albert’s response to the rat had become well established, Watson and Rayner showed that his fear readily generalized from the rat to other furry objects, such as a Santa Claus mask and a fur coat worn by Watson (Harris, 1979).

Most likely, the experiment caused Albert only temporary distress, because his fear extinguished rapidly. In fact, Watson and Rayner found it necessary to strengthen the child’s response periodically. This need to recondition Albert threatened the whole experiment when, after five days, Watson and Rayner were attempting to show that the child’s fear could be generalized to a dog, a rabbit, and a sealskin coat. Watson decided to “freshen the reaction to the rat” by again striking the steel bar. The noise startled the dog, which began to bark at Albert, frightening not only Little Albert but both experimenters (Harris, 1979).

Unlike Little Albert’s short-lived aversion to furry objects, some fears learned under extreme conditions can persist for years (LeDoux, 1996). Many sailors were exposed to such conditions during World War II, when the signal used to call them to battle stations was a gong sounding at the rate of 100 rings a minute. For combat personnel aboard ship, this sound was strongly associated with danger—a CS for emotional arousal. The persistent effect of this learning was shown in a study conducted 15 years after the war, when Navy veterans who had experienced combat still gave a strong autonomic reaction to the old “call to battle stations” (Edwards & Acker, 1962).

Like those veterans, any of us can retain a learned readiness to respond to old emotional cues. Fortunately, however, classical conditioning provides some tools for dealing with conditioned fears (Wolpe & Plaud, 1997). This process was first described by Mary Cover Jones in 1924, when she helped “uncondition” the fear that a 2-year old subject named Peter had toward a white rat and, by extension, a rabbit. Through a series of sessions in which she increased the “degrees of toleration,” the fear began to decrease, until, at the end of the study, Peter stated that he liked the rabbit. A good therapeutic strategy combines extinction of the conditioned fear response with learning a relaxation response to the CS. This *counterconditioning* therapy, then, teaches patients to respond in a relaxed manner to the conditioned stimulus. The technique has been particularly effective in dealing with phobias. It was also part of the treatment used to help Sabra conquer her fear of flying.

**Conditioned Food Aversions** As young children, all four of your authors had bad experiences with specific foods. Phil got sick after eating pork and beans in the grade school lunchroom. Ann developed nausea after eating apple fritters. And it was Bob who became ill after overdosing on olives. In all three cases, we associated our distress with the distinctive sight, smell, and taste of the food—but not to anything else in our environment. Even today, the taste, smell, or appearance of the specific food is enough to cause a feeling of nausea.

Unpleasant as it can be, learning to avoid a food associated with illness has survival value. That’s why humans and many other animals readily form an association between illness and food—much more readily than between illness and a nonfood stimulus, such as a light or a tone. And, although most forms of classical conditioning require only a short delay between the CS and the UCS, food aversions can develop when a distinctive taste has been separated by hours from the onset of illness. “Must have been something I ate!” we say.

John Garcia and Robert Koelling first recognized this selective CS–UCS connection when they noticed that rats avoided drinking from the water bottles



● John Watson and Rosalie Rayner conditioned Little Albert to fear furry objects like this Santa Claus mask (*Discovering Psychology*, 1990).

#### CONNECTION: CHAPTER 3

The *autonomic nervous system* regulates the internal organs.



● Bait shyness has survival value.

■ **Taste-aversion learning** A biological tendency in which an organism learns, after a single experience, to avoid a food with a certain taste, if eating it is followed by illness.



● A conditioned taste aversion can make a coyote stop killing sheep.

in the chambers where they had previously been made nauseated by radiation. Garcia and Koelling wondered: Could it be the taste of the water in those bottles that the rats were associating with being sick? Subsequent experiments confirmed their suspicions and led to yet another important discovery.

Garcia and Koelling (1966) found that rats readily learned an association between flavored water and illness, yet the rats could *not* be conditioned to associate flavored water with an electric shock delivered through a grid on the floor of the test chamber. This makes good “sense” from an evolutionary perspective, because illness can easily result from drinking (or eating) poisonous substances but rarely occurs following a sharp pain to the feet. On the other hand, the experiments found that rats easily learned to respond fearfully when bright lights and noise signaled an electric shock—but could *not* learn to connect those light/sound cues and subsequent illness.

**A Challenge to Pavlov** The problem that conditioned **taste-aversion learning** poses for classical conditioning is that it is not entirely learned. In fact, the tendency to develop taste aversions appears to be a part of our biological nature. And it is this biological basis for taste aversions that has caused psychologists to question some aspects of Pavlov’s original theory of classical conditioning.

Unlike conditioning dogs to respond to a tone or a light, food aversions seem to require an innate (and therefore *unlearned*) disposition to associate sickness with food. We know this because people who develop food aversions don’t normally make the same association to nonfood items that accompanied the food. For example, when Bob developed an aversion to olives, he did not also learn to avoid other objects in the room at the time, such as a light or a book on the table. It was solely the olives that became an effective conditioned stimulus. Taken together, such observations suggest that organisms have an inborn preparedness to associate certain stimuli with certain consequences, while other CS–UCS combinations are highly resistant to learning.

Moreover, food aversions can develop even when the time interval between eating and illness extends over several hours—as compared with just a few seconds in Pavlov’s experiments. Again, this suggests that in food aversions we are not dealing with a simple classically conditioned response as Pavlov understood it but, instead, with a response that is based as much in nature (biology) as it is in nurture (learning).

**Conditioning Coyotes: An Application** The principles behind conditioned food aversion have been applied to practical problems in the world outside the laboratory. For example, John Garcia and his colleagues demonstrated how aversive conditioning can dissuade wild coyotes from attacking sheep. The researchers did so by wrapping toxic lamb burgers in sheepskins and stashing them on sheep ranches. When roaming coyotes found and ate these morsels, they became sick and—as predicted—developed a distaste for lamb meat. The result was a 30 to 50% reduction in sheep attacks. So powerful was this aversion for conditioned coyotes that, when captured and placed in a cage with a sheep, the coyotes would not get close to it. Some even vomited at the sight of a sheep (Garcia, 1990). Perhaps the most amazing result was this: Despite their success with coyotes, the scientists have been unable to modify the behavior of sheep ranchers to get them to apply the research. Apparently, sheep ranchers have a strong aversion to feeding lamb to coyotes!

So, what is the big lesson of taste aversions for our understanding of classical conditioning? Conditioning involves both nature and nurture. That is, conditioning depends not only on the learned relationship among stimuli and responses but also on the way an organism is genetically attuned to certain



stimuli in its environment (Barker et al., 1978; Dickinson, 2001; Pinel, 2003). What any organism can—and cannot—learn in a given setting is to some extent a product of its evolutionary history (Garcia, 1993). This is a concept that Pavlov never understood.



## PSYCHOLOGY IN YOUR LIFE: TASTE AVERSIONS AND CHEMOTHERAPY

Imagine that your friend Jena is about to undergo her first round of chemotherapy, just to make sure that any stray cells from the tumor found in her breast will be destroyed. To her surprise, the nurse enters the lab, not with the expected syringe, but with a dish of licorice-flavored ice cream. “Is this a new kind of therapy?” she asks. The nurse replies that it is, indeed. She explains that most patients who undergo chemotherapy experience nausea, which can make them “go off their feed” and quit eating, just when their body needs nourishment to fight the disease. “But,” says the nurse, “We have found a way around the problem. If we give patients some unusual food before their chemotherapy, they will usually develop an aversion only to that food.” She continued, “Did you ever hear of Pavlov’s dogs?”

Cancer patients like Jena often develop aversions to normal foods in their diets to such an extent that they become anorectic and malnourished. The aversions are conditioned responses in which food (the CS) becomes associated with nausea. The problem is aggravated when chemotherapy treatments, which produce the nausea, are administered right after meals. Therapists trained to understand classical conditioning use their knowledge to prevent the development of aversions to nutritive foods by arranging for meals not to be given just before the chemotherapy. And, as in Jena’s case, they also present a “scapegoat” stimulus. Thus, patients are given candies or ice cream with unusual flavors before the treatments so that the taste aversion becomes conditioned only to those special flavors. For some patients, this practical solution to problems with chemotherapy may make the difference between life and death (Bernstein, 1988, 1991).



● If this child gets sick tonight, she may develop a taste aversion to this unusual flavor of ice cream.

## CHECK YOUR UNDERSTANDING

- RECALL:** Classical conditioning is especially useful for understanding which one of the following examples of learning?
  - a child who, after a painful dental visit, has learned to fear the dentist
  - a dog that has learned to “sit up” for a food reward
  - an executive who is afraid that she will lose her job
  - a rat that has learned to run a maze
  - a psychology student who is learning how memory works
- RECALL:** The responses in classical conditioning were originally
  - new behaviors.
  - premeditated behaviors.
  - random acts.
  - trained reflexes.
  - innate reflexes.
- APPLICATION:** If you learned to fear electrical outlets after getting a painful shock, from plugging in a light, what would be the CS?
  - the time period between seeing the outlet and getting the shock
  - the prong on the light cord
  - the electrical outlet
  - the painful shock
  - the fear
- UNDERSTANDING THE CORE CONCEPT:** Which of the following would be most likely to be an unconditioned stimulus (UCS) involved in classical conditioning?
  - praise
  - money
  - music
  - a flashing light
  - food

ANSWERS: 1 a 2 e 3 c 4 e





## HOW DO WE LEARN NEW BEHAVIORS BY OPERANT CONDITIONING?

With classical conditioning, you can teach a dog to salivate, but you can't teach it to sit up or roll over. Why? Salivation is a passive, involuntary reflex, while sitting up and rolling over are much more complex responses that we usually think of as voluntary. To a behavioral psychologist, however, such "voluntary" behaviors are really controlled by *rewards* and *punishments*—which have no role in classical conditioning. When rewards or punishments are involved, another important form of learning is at work. Psychologists call it *operant conditioning*. An **operant**, incidentally, is an observable behavior that an organism uses to "operate" in, or have an effect on, the environment. Thus, if you are reading this book to get a good grade on the next test, reading is an operant behavior.

You might also think of **operant conditioning** as a form of learning in which behavior change is brought about by the *consequences* of behavior. The Core Concept of this section puts the idea this way:



In operant conditioning, the consequences of behavior, such as rewards and punishments, influence the chance that the behavior will occur again.

Common rewarding consequences include money, praise, food, or high grades—all of which can encourage the behaviors they follow. By contrast, punishments such as pain, loss of privileges, or low grades can discourage the behaviors with which they are associated.

As you will see, the theory of operant conditioning is an important one for at least two reasons. First, operant conditioning accounts for a much wider spectrum of behavior than does classical conditioning. And second, it explains new behaviors—not just reflexive behaviors.

### Skinner's Radical Behaviorism

The founding father of operant conditioning, American psychologist B. F. Skinner (1904–1990), based his whole career on the idea that the most powerful influences on behavior are its *consequences*. Actually, it wasn't Skinner's idea, originally. He borrowed the concept of behavior being controlled by rewards and punishments from another American psychologist, Edward Thorndike, who had demonstrated how hungry animals would work diligently to solve a problem by trial and error to obtain a food reward. Gradually, on succeeding trials, erroneous responses were eliminated and effective responses were "stamped in." Thorndike called this the **law of effect**. (See Figure 6.3.)

The first thing Skinner did with Thorndike's psychology, however, was to rid it of subjective and unscientific speculation about the organism's feelings, intentions, or goals. What an animal "wanted" or the "pleasure" it felt was not important for an objective understanding of the animal's behavior. As a radical behaviorist, Skinner refused to consider what happens in an organism's mind, because such speculation cannot be verified by observation. For example, eating can be observed, but we can't observe the inner experiences of hunger, the desire for food, or pleasure at eating.

### The Power of Reinforcement

While we often speak of "reward" in casual conversation, Skinner preferred the more objective term **reinforcer**. By this he meant any condition that follows and strengthens a response. Food, money, and sex serve this function for



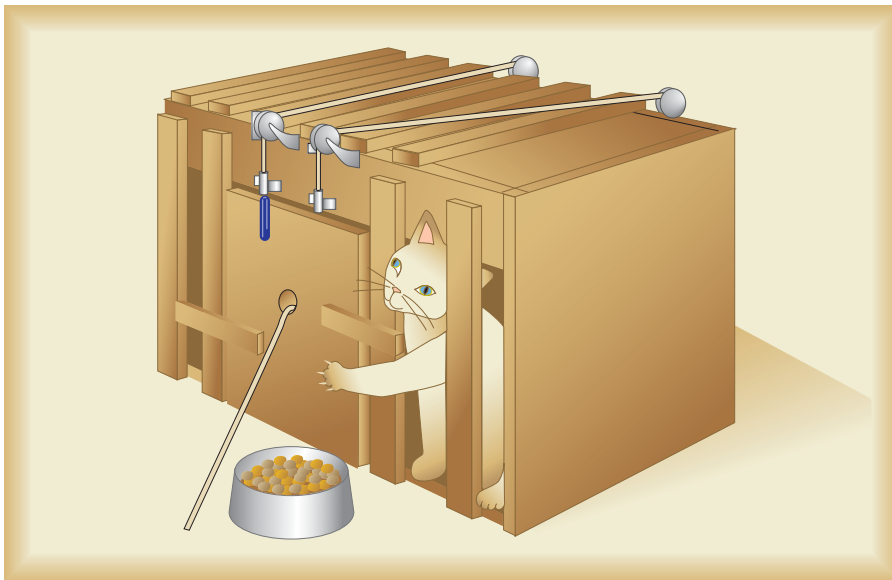
● Taking aspirin for pain usually results in negative reinforcement, because the pain diminishes.

■ **Operant** An observable, voluntary behavior that an organism emits to "operate" on, or have an effect on, the environment.

■ **Operant conditioning** A form of behavioral learning in which the probability of a response is changed by its consequences—that is, by the stimuli that *follow* the response.

■ **Law of effect** The idea that responses that produced desirable results would be learned, or "stamped" into the organism.

■ **Reinforcer** A condition (involving either the presentation or removal of a stimulus) that occurs after a response and strengthens that response.



● **FIGURE 6.3** A Thorndike Puzzle Box

Unlike Pavlov's dogs, Thorndike's cats faced a problem: how to open the door in the puzzle box to get a food reward lying just outside. To solve this problem, the animals used *trial-and-error learning*, rather than simple reflexive responses. At first, their responses seemed random, but gradually they eliminated ineffective behaviors. And when the effects of their behavior were desirable (that is, when the door finally opened and the animals got the food), they used this strategy on subsequent trials. This change in behavior based on outcome of previous trials is called the *law of effect*. Much the same trial-and-error learning occurs when you learn a skill, such as shooting a basketball.

most people. So do attention, praise, or a smile. All are examples of **positive reinforcement**, which strengthens a response by occurring after the response and making the behavior more likely to occur again.

Most people know about positive reinforcement, of course, but few people understand the other main way to strengthen operant responses. It involves the reinforcement of behavior by the *removal* of an unpleasant or aversive stimulus. Psychologists call this **negative reinforcement**. (The word "negative" here is used in the mathematical sense of *subtract* or *remove*, while "positive" means *add* or *apply*.) Using an umbrella to avoid getting wet during a down-pour is a behavior learned and maintained by negative reinforcement. That is, you use the umbrella to avoid or remove an unpleasant stimulus (getting wet). Likewise, when a driver buckles the seat belt, negative reinforcement occurs as the annoying sound of the seat-belt buzzer stops. Remember, it is the "subtraction" of the unpleasant stimulus that provides negative reinforcement.

**Reinforcing Technology: The "Skinner Box"** One of B. F. Skinner's (1956) most important innovations was a simple device for studying the effects of reinforcers on laboratory animals: a box with a lever that an animal could press to obtain food, which he called an **operant chamber**. Nearly everyone else called it a "Skinner box," a term he detested. Over the intervening years, the apparatus has been used by thousands of psychologists to study operant conditioning.

The importance of the operant chamber was that it could be set to control the timing and the frequency of reinforcement. These factors, it turned out, are of huge importance in controlling behavior, as you will see in our discussion of *contingencies of reinforcement*. Moreover, the Skinner box could be programmed to conduct experiments at any time—even when the researcher was home in bed.

And speaking of beds, just to set the record straight, we'd like to mention a bit of trivia about the "baby tender" crib Skinner devised for his daughter, Deborah (Benjamin & Nielsen-Gammon, 1999). It consisted of an enclosed, temperature-controlled box—which unfortunately bore a superficial resemblance to the operant chambers used in his experiments. The public learned about the "baby tender" from an article by Skinner in the magazine *Ladies' Home Journal*. Many readers (and also those who did *not* read the article) jumped to wild



● B. F. Skinner is shown reinforcing the animal's behavior in an operant chamber, or "Skinner box." The apparatus allows the experimenter to control all the stimuli in the animal's environment.

■ **Positive reinforcement** A stimulus presented after a response and increasing the probability of that response happening again.

■ **Negative reinforcement** The removal of an unpleasant or aversive stimulus, contingent on a particular behavior. Compare with *punishment*.

■ **Operant chamber** A boxlike apparatus that can be programmed to deliver reinforcers and punishers contingent on an animal's behavior. The operant chamber is often called a "Skinner box."



● Chimpanzees will work for conditioned reinforcers. Here a chimp has earned plastic tokens, which it is depositing in a “chimp-o-mat” to obtain raisins, a primary reinforcer.



● Parents can use reinforcement contingencies to affect children’s behavior.

### ■ Reinforcement contingencies

Relationships between a response and the changes in stimulation that follow the response.

### ■ Continuous reinforcement

A type of reinforcement schedule by which all correct responses are reinforced.

■ **Shaping** An operant learning technique in which a new behavior is produced by reinforcing responses that are similar to the desired response.

### ■ Intermittent reinforcement

A type of reinforcement schedule by which some, but not all, correct responses are reinforced; also called *partial reinforcement*.

### ■ Extinction (in operant conditioning)

A process by which a response that has been learned is weakened by the absence or removal of reinforcement. (Compare with *extinction in classical conditioning*.)

conclusions involving child neglect and heartless experimentation. The story of the “baby tender” took on a life of its own, and, years later, stories arose about Deborah Skinner’s supposed psychotic breakdown, lawsuits against her father, and eventual suicide—none of which were true. In this case, the truth was not nearly as titillating as the fiction. In fact, Deborah grew up to be a well-adjusted individual who loved her parents.

**Contingencies of Reinforcement** College and university students are reinforced for their studying with grade reports two or three times a year. Because that’s too long between reinforcers for most students to maintain their academic behavior, professors schedule exams and award grades periodically throughout their courses. They want to encourage continual studying, rather than one big push at the end of the semester.

In any operant learning situation, the timing and frequency of rewards are crucial. How often will reinforcement be given? How much work is needed to earn a reinforcer? Will every response be reinforced—or will reinforcement occur only after a certain number of responses? These are the important questions we will pose in our discussion of **reinforcement contingencies**, which will deal with the many possible ways of associating responses and reinforcers. As you will see, the answers to these questions determine the behavior patterns of organisms, from laboratory rats to students (and their professors).

**Continuous versus Intermittent Reinforcement** Suppose you want to teach your dog a trick—say, sitting up on command. It would be a good idea to begin the training program with a reward for every correct response. Psychologists call this **continuous reinforcement**. It’s a useful tactic early in the learning process, because rewarding every correct response gives feedback on how well each response was performed. In addition, continuous reinforcement is useful for **shaping** complex new behaviors, such as playing a musical instrument, because the teacher can continually “raise the bar,” or increase the standard required for earning a reward, which tells the learner when performance has improved. In general, then, we can say that *continuous reinforcement is the best strategy for teaching and learning new behaviors*.

Continuous reinforcement does have some drawbacks, however. For one thing, an accidental failure to reward a correct response on one trial could easily be misinterpreted as a signal that the response was not correct. For another, continuous reinforcement typically loses its reinforcing quality as the organism becomes satiated, as you can imagine if someone were training you to shoot free throws by rewarding you with chocolate cake. Your first slice of chocolate cake may be highly rewarding, but by the time you have had 10 or 12 slices, the reward value is gone.

Happily, once the desired behavior is well established (for example, when your dog has learned to sit up), the demands of the situation change. The learner no longer needs rewards to discriminate a correct response from an incorrect one. Now is the time to shift to **intermittent reinforcement** (also called *partial reinforcement*), the rewarding of some, but not all, correct responses. A less frequent schedule of reward—perhaps, after every third correct response—can still serve as an incentive for your dog to sit up on command. In general, whether we’re dealing with people or animals, *intermittent reinforcement is the most efficient way to maintain behaviors that have already been learned* (Robbins, 1971; Terry, 2000).

A big advantage of intermittent reinforcement comes from the resistance to *extinction* that it produces. Much like the extinction we saw in Pavlovian conditioning, **extinction** also occurs in operant conditioning. The operant version



of extinction occurs when reinforcement is withheld, as when a gambler quits playing a slot machine that never pays off. Why do responses strengthened by partial reinforcement resist extinction much more strongly than responses that have been rewarded continuously? Imagine two gamblers and two slot machines. One machine inexplicably pays off on every trial, and another, a more typical machine, pays on an unpredictable, intermittent schedule. Now, suppose that both devices suddenly stop paying. Which gambler will catch on first? The one who has been rewarded for each pull of the lever (continuous reinforcement) will quickly notice the change, while the gambler who has won only occasionally (on partial reinforcement) may continue playing unrewarded for a long while.

**Schedules of Reinforcement** Now that you are convinced of the power of intermittent reinforcement, you should know that it occurs in two main forms or **schedules of reinforcement**. One, the **ratio schedule**, rewards a subject after a certain *number of responses*. The other, known as an **interval schedule**, provides a reward after a certain *time interval*. Let's look at the advantages and disadvantages of each.

**Ratio Schedules** If you pay your employees based on the amount of work they perform, you are using a ratio schedule of reinforcement. Ratio schedules occur any time rewards are *based on the number of responses* (see Figure 6.4). Psychologists make a further distinction between two subtypes of ratio schedules: *fixed ratio* and *variable ratio* schedules.

**Fixed ratio (FR) schedules** are found in jobs where workers are paid on a piecework basis. Suppose that you own a tire factory, and you pay each worker a dollar for every 10 tires produced; you are using a fixed ratio schedule. Under this scheme, the amount of work (the number of responses) needed for a reward remains constant. Managers like FR schedules because the rate of responding is usually high (Terry, 2000; Whyte, 1972).

**Variable ratio (VR) schedules** are less predictable. Telemarketers—people who make sales pitches by telephone—work on a VR schedule: They never know how many phone calls they must make before they get the next sale. Slot machine players also respond on a variable ratio schedule. In both cases the variable ratio schedule keeps responses coming at a high rate—so high, in fact, that the VR schedule usually produces more responding than any other schedule of reinforcement. In the laboratory, Skinner demonstrated that a variable ratio schedule could entice a hungry pigeon to peck a disk 12,000 times an hour for rewards given, on the average, for every 110 pecks.

**Interval Schedules** Time is of the essence on an interval schedule. Accordingly, reinforcement is based on responses made within a certain *time period* (instead of on the number of responses given). (See Figure 6.4.) Psychologists distinguish two kinds of interval schedules: *fixed interval* and *variable interval* schedules.

**Fixed interval (FI) schedules** are common in the work world, where they may appear as a monthly paycheck. A student who studies for a weekly quiz is also on a fixed interval



● Continuous reinforcement is useful for *training* animals, but intermittent reinforcement is better for *maintaining* their learned behaviors.

#### ■ Schedules of reinforcement

Programs specifying the frequency and timing of reinforcements.

■ **Ratio schedule** A program by which reinforcement depends on the number of correct responses.

■ **Interval schedule** A program by which reinforcement depends on the time interval elapsed since the last reinforcement.

■ **Fixed ratio (FR) schedules** Programs by which reinforcement is contingent on a certain, unvarying number of responses.

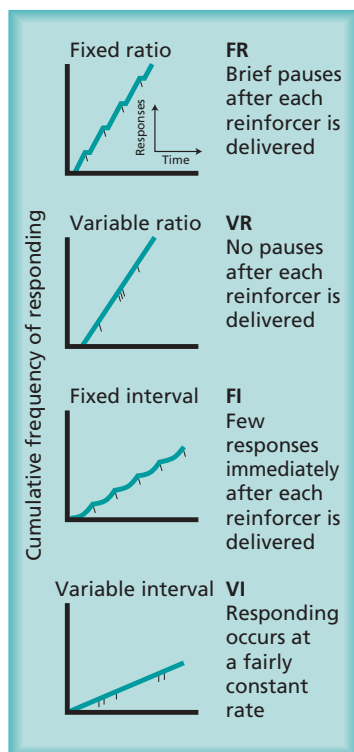
■ **Variable ratio (VR) schedules** Reinforcement programs by which the number of responses required for a reinforcement varies from trial to trial.

■ **Fixed interval (FI) schedules** Programs by which reinforcement is contingent on a certain, fixed time period.



● What schedule of reinforcement encourages this man to buy lottery tickets?





● **FIGURE 6.4** Reinforcement Schedules

These graphs show typical patterns of responding produced by four different schedules of reinforcement. (The hatch marks indicate when reinforcement is delivered.) Notice that the steeper angle of the top two graphs shows how the ratio schedules usually produce more responses over a given period of time than do the interval schedules.

#### ■ Variable interval (VI) schedules

Programs by which the time period between reinforcements varies from trial to trial.

■ **Primary reinforcers** Reinforcers, such as food and sex, that have an innate basis because of their biological value to an organism.

■ **Conditioned reinforcers or secondary reinforcers** Stimuli, such as money or tokens, that acquire their reinforcing power by a learned association with primary reinforcers.

■ **Token economy** A therapeutic method, based on operant conditioning, by which individuals are rewarded with tokens, which act as secondary reinforcers. The tokens can be redeemed for a variety of rewards and privileges.

schedule. Because the interval is invariant, the time period between rewards remains constant. You may have already guessed that fixed interval reinforcement usually results in a low response rate. Ironically, this is the schedule most widely adopted by business. Even a rat in a Skinner box programmed for a fixed interval schedule soon learns that it must produce only a limited amount of work during the interval in order to get its reward. Lever presses beyond the required minimum are just wasted energy. Thus, both rats and humans on fixed interval schedules may display only modest productivity until near the end of the interval, when the response rate increases rapidly. (Think of college students facing a term paper deadline.) Graphically, in Figure 6.4 you can see the “scalped” pattern of behavior that results from this flurry of activity near the end of each interval.

**Variable interval (VI) schedules** are, perhaps, the most unpredictable of all. On a VI schedule, the time interval between rewards varies. The resulting rate of responding can be low or high, although not usually as high as for the VR schedule. For a pigeon or a rat in a Skinner box, the variable interval schedule may be a 30-second interval now, 3 minutes next, and a 1-minute wait later. On the job, random visits by the boss occur on a variable interval schedule. Fishing represents still another example: You never know how long it will be before the fish start biting again, but the occasional, unpredictable fish delivers reward enough to encourage fishing behavior over long intervals. And, while waiting for an elevator, it is fun to note which of your companions presses the button as if it controlled the arrival of the elevator on a VI schedule.

**Primary and Secondary Reinforcers** It is easy to see why stimuli that fulfill basic biological needs or desires will provide reinforcement: Food reinforces a hungry animal, and water reinforces a thirsty one. Similarly, the opportunity for sex becomes a reinforcer for a sexually aroused organism. Psychologists call such stimuli **primary reinforcers**.

But you can’t eat money or drink it. So why does money act as a powerful reinforcer for most people? Neutral stimuli that are associated with primary reinforcers may also acquire a reinforcing effect and become **conditioned reinforcers** or **secondary reinforcers** for operant responses. And that’s where money enters the picture; the system works similarly with grades, praise, smiles of approval, gold stars, and various kinds of status symbols. In fact, virtually any stimulus can become a secondary or conditioned reinforcer by being associated with a primary reinforcer. With strong conditioning, secondary reinforcers such as money, status, or awards can even come to be ends in themselves.

The power of conditioned reinforcers has been tapped by mental institutions that have set up so-called *token economies* to encourage desirable and healthy patient behaviors. Under a **token economy**, grooming or taking medication, for example, may be reinforced by plastic tokens awarded by the staff when patients perform these desired behaviors. The tokens can later be exchanged by patients for a wide array of rewards and privileges (Ayllon & Azrin, 1965; Holden, 1978). As an adjunct to other forms of therapy, token economies can help mental patients learn useful strategies for acting effectively in the world (Kazdin, 1994).

**Preferred Activities as Reinforcers: The Premack Principle** The opportunity to perform desirable activities can reinforce behavior just as effectively as food or drink or other primary reinforcers. For example, people who work out regularly might use a daily run or fitness class as a reward for getting other tasks done. Likewise, teachers have found that young children will learn to sit still

if that behavior is reinforced with the opportunity to run around and make noise (Homme et al., 1963).

The principle at work here says that a preferred activity (running around and making noise) can be used to reinforce a less preferred one (sitting still and listening to the teacher). Psychologists call this the **Premack principle**, after its discoverer, David Premack (1965). He first demonstrated this in thirsty rats, which increased their running in an exercise wheel when they learned that the running would be followed by an opportunity to drink. And, just as Premack had anticipated, another group of rats that were exercise deprived, but not thirsty, increased the amount they drank when drinking was followed by a chance to run in the wheel. In exactly the same way, then, parents can use the Premack principle to get children to engage in otherwise unlikely behavior. For example, the opportunity to play with friends (a preferred activity) could be used to reinforce the less-preferred activity of making the bed or doing the dishes.

**Reinforcement across Cultures** The laws of operant learning apply to all animals with a brain. The biological mechanism underlying reinforcement is, apparently, much the same across species. On the other hand, exactly what serves as a reinforcer varies wildly. Experience suggests that food for a hungry organism and water for a thirsty one will act as reinforcers because they satisfy basic needs related to survival. But what any particular individual will choose to satisfy those needs may depend as much on learning as on survival instincts—especially in humans, where secondary reinforcement is so important. For us, culture plays an especially powerful role in determining what will act as reinforcers. So, while some people would find eating a cricket reinforcing, most people of Euro-American ancestry would not. Similarly, disposing of a noisy cricket might seem both sensible and rewarding to a Baptist and aversive to a Buddhist. And, just to prove our point, we note that watching a game of cricket would most likely be rewarding to a British cricket fan—although punishingly dull to most Americans.

So, culture shapes preferences in reinforcement, but reinforcement also shapes culture. When you first walk down a street in a foreign city, all the differences that catch your eye are merely different ways that people have found to seek reinforcement or avoid punishment. A temple houses cultural attempts to seek rewards from the deity. Clothing may reflect attempts to seek a reinforcing mate or to feel comfortable in the climate. And a culture's cuisine evolves from learning to survive on the native plants and animals. It is in this sense, then, that we can see culture broadly as a set of behaviors originally *learned* by operant conditioning and shared by a group of people.

## The Problem of Punishment

**Punishment** as a means of influencing behavior poses several difficulties, as schoolteachers and prison wardens will attest. In some respects, punishment acts as the opposite of reinforcement. Thus, punishment is an *aversive* consequence used to *weaken* the behavior it follows. But, like reinforcement, punishment comes in two main forms. One, called **positive punishment**, requires the *application of an aversive stimulus*—as, when you touch a hot plate, the painful consequence reduces the likelihood of your repeating that behavior. The other main form of punishment, known as **omission training** or **negative punishment**, results from the *removal of a reinforcer*—as when parents take away a misbehaving teen's car keys.



● Foods that many people around the world enjoy may not be a source of reinforcement for the typical North American.

■ **Premack principle** The concept, developed by David Premack, that a more-preferred activity can be used to reinforce a less-preferred activity.

■ **Punishment** An aversive stimulus which, occurring after a response, diminishes the strength of that response. (Compare with *negative reinforcement*.)

■ **Positive punishment** The application of an aversive stimulus after a response.

■ **Omission training (negative punishment)** The removal of an appetitive stimulus after a response, leading to a decrease in behavior.

- As Calvin realizes, the probability of someone repeating a response can be decreased if the first response is followed by an aversive consequence, such as a loud noise or angry complaint.



Calvin & Hobbes by Bill Watterson/Universal Press Syndicate.

Unlike reinforcement, however, punishment must be administered consistently. Intermittent punishment is far less effective than punishment delivered after every undesired response. In fact, *not punishing* an occurrence of unwanted behavior can have the effect of rewarding it—as when a supervisor overlooks the late arrival of an employee.

**Punishment versus Negative Reinforcement** You have probably noted that punishment and negative reinforcement both involve unpleasant stimuli. So, to avoid confusion, let's see how punishment and negative reinforcement differ, using the following examples (Figure 6.5). Suppose that an animal in a Skinner box can turn off a loud noise by pressing a lever: This action provides negative reinforcement. Now compare that with the other animal in Figure 6.5 for which the loud noise serves as a punishment for pressing the lever.

Please note that punishment and negative reinforcement are used to produce opposite effects on behavior (Baum, 1994). Punishment is used to *decrease* a behavior or reduces its probability of recurring. In contrast, negative reinforcement—like positive reinforcement—always *increases* a response's probability of occurring again.

And remember that the descriptors “positive” and “negative” mean “add” and “remove.” Thus, both positive reinforcement and positive punishment involve administering or “adding” a stimulus. On the other hand, negative reinforcement and negative punishment always involve withholding or removing a stimulus. For a concise summary of the distinctions between positive and negative reinforcement and punishment, please see Table 6.1.

● **FIGURE 6.5** Negative Reinforcement and Punishment Compared

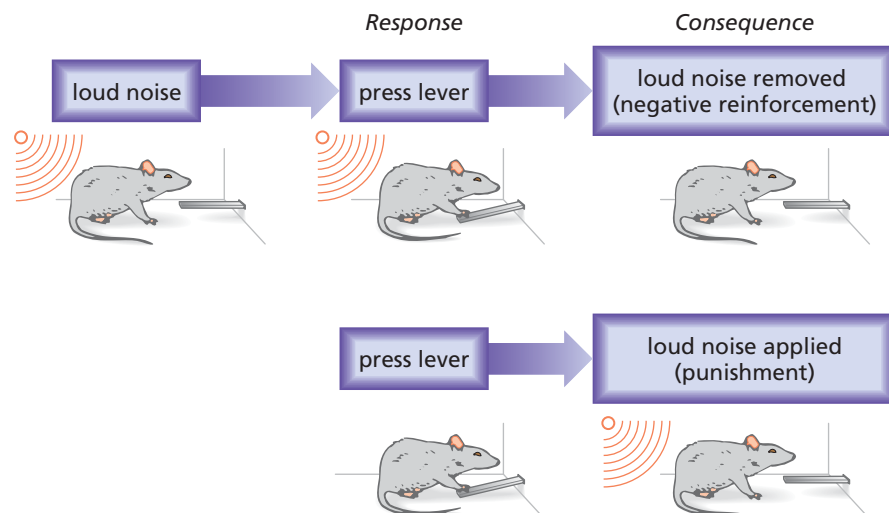






TABLE 6.1

Contingency Diagram of Operant Conditioning

	+ (Positive or appetitive) Stimulus	– (Negative or aversive) Stimulus
+ Present	 <b>Positive Reinforcement</b> (Increases behavior)	 <b>Punishment</b> (Decreases behavior)
– Remove	 <b>Omission Training, or Negative Punishment</b> (Decreases behavior)	 <b>Negative Reinforcement</b> (Increases behavior)

Three important points to keep in mind as you study this table:

1. The terms “positive” and “negative” mean that a stimulus (consequence) has been added (presented) or subtracted (removed). They have nothing to do with “good” or “bad.”
2. We can often predict what effect a particular consequence will have, but the only way to know for sure whether it will be a reinforcer or a punisher is to observe its effect on behavior. For example, although we might guess that a spanking would punish a child, it might actually serve as a reinforcer to strengthen the unwanted behavior.
3. From a cognitive viewpoint, we can see that reinforcement consists of the presentation of a pleasant stimulus or the removal of an unpleasant one. Similarly, punishment entails the presentation of an unpleasant stimulus or the removal of a pleasant one, as in the case of omission training.

**The Uses and Abuses of Punishment** Our society relies heavily on punishment and the threat of punishment to keep people “in line.” We put people in jail, fine them, spank them, and give them bad grades, parking tickets, and disapproving looks. And what is the result? Punishment often produces an immediate change in behavior—which, ironically, is reinforcing to the punisher and a major reason why the use of punishment is so widespread. Several other factors also encourage a punishment habit. For one, punishers may feel good while delivering the punishment, sensing that they are “settling a score” or “getting even” or making the other person “pay.” This is why we speak of revenge as being “sweet.”

But, punishment usually doesn’t work as well in the long run as punishers would like (Terry, 2000). Punished children may continue to misbehave, reprimanded employees may still arrive late for work, and, in the United States, many people still commit crimes, despite the fact that we imprison criminals in numbers that far exceed those of any other Western society. Why is punishment so difficult to use effectively? There are several reasons.

First, *the power of punishment to suppress behavior usually disappears when the threat of punishment is removed* (Skinner, 1953). Drivers will observe the speed limit when they know the highway patrol is watching. Johnny will refrain from hitting his little brother when his parents are within earshot. And you will probably give up your wallet to a mugger who points a gun at you. That is, most people will comply with a demand accompanied by the threat of strong and certain punishment. But they may act quite differently when they know punishment is unlikely. This explains why motorists rarely slow down for “construction speed” signs on the highways: They know that the police rarely enforce these zones. In general, you can be certain of controlling someone’s behavior through punishment or threat of punishment only if you can control the environment all of the time. Such total control is usually not possible, even in a prison.

Second, *punishment triggers escape or aggression*. When punished, organisms usually try to flee from or otherwise avoid further punishment. But if escape is blocked, they are likely to become aggressive. Corner a wounded animal,



● Prison riots and other aggressive behavior may result from highly punitive conditions.



and it may savagely attack you. Put two rats in a Skinner box with an electrified floor grid, and the rats will attack each other (Ulrich & Azrin, 1962). Put humans in a harsh prison environment, and they may riot—or, if they are prison guards, they may abuse the prisoners (Zimbardo, 2004c).

Further, in a punitive environment, whether it be a prison, a school, or a home, people learn that punishment and aggression are legitimate means of influencing others, which may explain the smiling faces of the guards seen in the prisoner-abuse photos from Iraq. The punishment–aggression link also explains why abusing parents so often come from abusive families and why aggressive delinquents so often come from homes where aggressive behavior toward the children is commonplace (Golden, 2000). Unfortunately, the well-documented fact that punishment so often leads to aggression remains widely unknown to the general public.

Here's the third reason why punishment is so often ineffective: *Punishment makes the learner apprehensive, which inhibits learning new and better responses.* Unable to escape punishment, an organism may give up its attempts at flight or fight and surrender to an overwhelming feeling of hopelessness. This passive acceptance of a punitive fate produces a behavior pattern called *learned helplessness* (Overmier & Seligman, 1967). In people, this reaction can produce the mental disorder known as depression (Terry, 2000).

From the standpoint of a punisher seeking to produce a constructive change in attitudes and behavior, learned helplessness and depression are undesirable outcomes. Whether it produces escape, aggression, or learned helplessness, punishment focuses learners' attention on their own misery—which interferes with new learning. It also fails to help learners see what to do because it focuses attention on what not to do. By contrast, individuals who have not been punished feel much freer to experiment with new behaviors.

And the fourth reason why punitive measures may fail: *Punishment is often applied unequally*, even though that violates our standards of fair and equal treatment. For example, boys are punished more often than girls. Then, too, children (especially grade school children) receive more physical punishment than do adults. And, to give one more example, our schools—and probably our society at large—more often use punishment to control members of racial minority groups than they do to control members of the Caucasian majority (Hyman, 1996; Hyman et al., 1977).

**Does Punishment Ever Work?** In limited circumstances, punishment can work remarkably well (Terry, 2000). For example, punishment can halt the self-destructive behavior of autistic children who may injure themselves severely by banging their heads or chewing the flesh off their fingers. In these cases, a mild electric shock or a splash of cold water in the face can quickly put a stop to the unwanted behavior, although the effects may be temporary (Holmes, 2001; Linsheid et al., 1990; Lovaas, 1977; Lovaas et al., 1974).

Before you decide on punishment, we suggest you consider extinction and the rewarding of desirable alternative responses. But, if punishment seems to be the only option, it should at least meet the following conditions (Walters & Grusec, 1977):

- *Punishment should be swift*—that is, immediate. Any delay will decrease its effectiveness, so “You’ll get spanked when your father gets home” is a poor punishment strategy.
- *Punishment should be certain*—that is, consistently administered every time the unwanted response occurs. When “bad” behavior goes unpunished, the unintended effect can actually be rewarding.
- *Punishment should be limited in duration and intensity*—just enough to stop the behavior but appropriate enough to “make the punishment fit the crime.”

#### CONNECTION: CHAPTER 12

Depression is one of the most common mental disorders.

- *Punishment should clearly target the behavior, not the character of the person.*
- *Punishment should be limited to the situation in which the response occurred.*
- *Punishment should not give mixed messages to the punished person (such as, “You are not permitted to hit others, but I am allowed to hit you”).*
- *The most effective punishment is usually omission training (negative punishment), such as loss of privileges, rather than the application of unpleasant stimuli, such as pain.*

## Operant and Classical Conditioning Compared

Now that we have looked at the main features of operant and classical conditioning, let’s compare them side by side. As you can see in Table 6.2 and the diagrams in Figure 6.6 it is, most obviously, the *consequences* of behavior—especially, rewards and punishments—that make operant conditioning different from classical conditioning. One note of caution: You can see in the diagram of operant learning that food rewards the dog for sitting up. But you will also see food being presented to the dog as an unconditioned stimulus, in the classical conditioning portion of Figure 6.6. The important thing to observe, however, is that in classical conditioning the food comes *before* the response—and therefore it cannot serve as a reward.

Classical conditioning and operant conditioning also differ in the sequence of stimulus and response. Classically conditioned behavior is largely a response to *past stimulation*, while operant behavior is directed at attaining some *future* reinforcement or avoiding a punishment. To say it another way, operant conditioning requires a stimulus that follows the response, whereas classical conditioning ends with the response. (See Figure 6.7.)

The rewards given in operant conditioning can be especially effective in encouraging *new behaviors*—whether they be pulling slot machine levers, making beds, brushing teeth, going to work, or studying for an exam. Classical conditioning, on the other hand, emphasizes eliciting the *same responses to new stimuli*—such as salivating at the sound of a bell or flinching at the sound of a dentist’s drill.

You will also note that extinction works in slightly different ways in the two forms of learning. In classical conditioning, it requires withholding the unconditioned stimulus, while in operant



● Animals can learn to do surprising things with a little help from operant conditioning techniques, such as shaping.

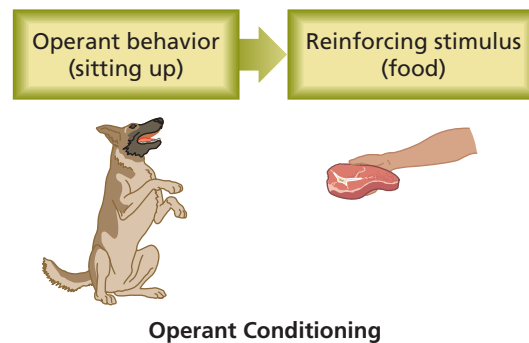
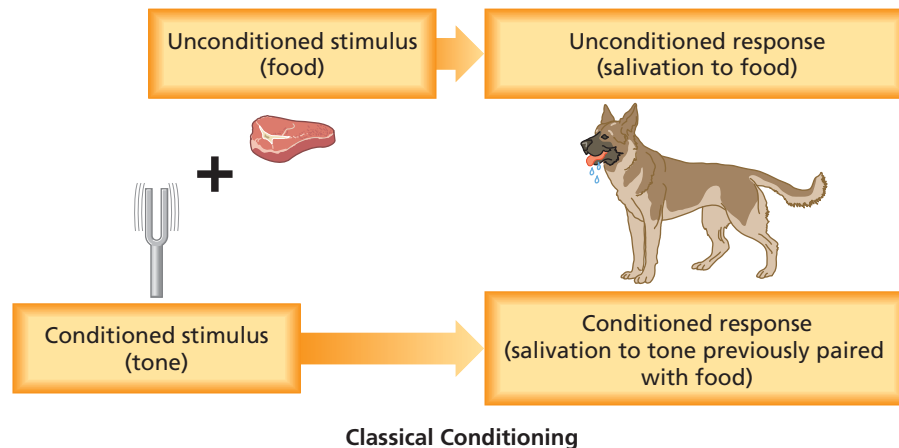
**TABLE 6.2**

**Classical and Operant Conditioning Compared**

Classical conditioning	Operant conditioning
Behavior is controlled by stimuli that <i>precede</i> the response (by the CS and UCS).	Behavior is controlled by consequences (rewards, punishments, etc.) that <i>follow</i> the response.
No reward or punishment is involved (although pleasant and aversive stimuli may be used).	Often involves reward (reinforcement) or punishment.
Through conditioning, a new stimulus (the CS) comes to produce “old” (reflexive) behavior.	Through conditioning, a new stimulus (a reinforcer) produces new behavior.
Extinction is produced by withholding the UCS.	Extinction is produced by withholding reinforcement.
Learner is passive (responds reflexively): Responses are involuntary. That is, behavior is <i>elicited</i> by stimulation.	Learner is active (operant behavior): Responses are voluntary. That is, behavior is <i>emitted</i> by the organism.

● **FIGURE 6.6** The Same Stimulus Plays Different Roles in Classical Conditioning and Operant Conditioning

The same stimulus (food) can play vastly different roles, depending on which type of conditioning is involved. In classical conditioning, it can be the UCS, while in operant conditioning it can serve as a reinforcer for operant behavior. Note also that classical conditioning involves the association of two stimuli that occur *before* the response. Operant conditioning involves a reinforcing (rewarding) or punishing stimulus that occurs *after* the response.

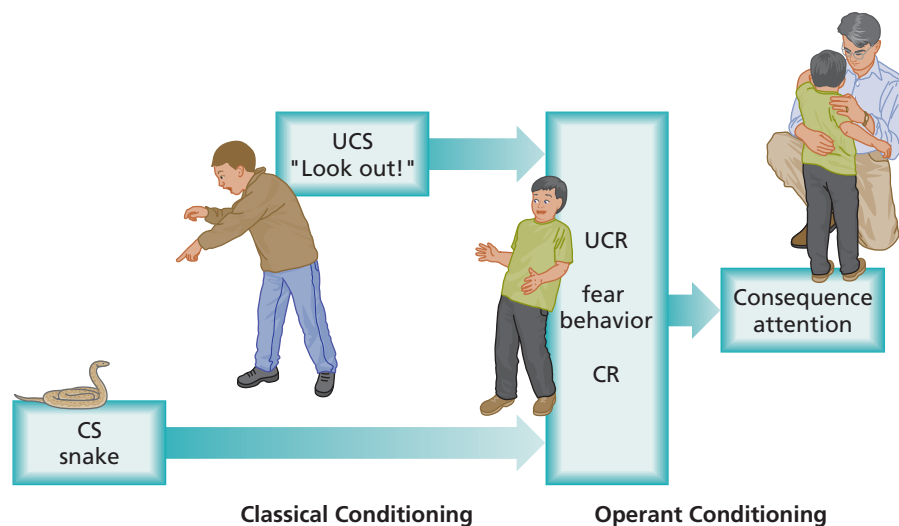


conditioning the reinforcer must be withheld. In both cases, however, the result is a gradual fading of the response.

Operant conditioning and classical conditioning differ in several other important ways that you see in Table 6.2. For one, operant behavior is not based on an automatic reflex action, as was the dog's salivation or Little Albert's crying. Accordingly, operant behavior seems more "voluntary"—more under the

● **FIGURE 6.7** Classical and Operant Conditioning Can Work Together

A response originally learned through classical conditioning can be maintained and strengthened by operant reinforcement.



control of the responder. To paraphrase a proverb: You can stimulate a dog to salivation (a reflex), but you can't make it eat (an operant behavior).

But don't make the mistake of thinking that classical and operant conditioning are competing explanations for learning. They can be complementary. In fact, responses that were originally learned by classical conditioning will often be maintained later by operant conditioning. How might this happen? Consider a snake phobia. Suppose that the fear of snakes was originally learned by classical conditioning when a snake (CS) was paired with a frightening UCS (someone yelling, "Look out!"). Once the phobic response is established, it could be maintained and strengthened by operant conditioning, as when bystanders give attention to the fearful person (see Figure 6.7). Similarly, the attention Bob, one of your authors, gets from refusing to eat olives encourages the aversion that he originally learned by classical conditioning.



## PSYCHOLOGY IN YOUR LIFE: A CHECKLIST FOR MODIFYING OPERANT BEHAVIOR

Think of someone whose behavior you would like to change. For the sake of illustration, let's focus on your nephew Johnny's temper tantrums, which always seem to occur when you take him out in public. Operant conditioning offers a variety of tools that can help, provided you have some control over stimuli that are important to Johnny. Let's consider a checklist of these operant tools: positive reinforcement, punishment, negative reinforcement, and extinction.

- *Positive reinforcement* is a good bet, especially if you can find some desirable behavior to reinforce before the unwanted behavior occurs. And don't overlook the Premack principle, by which Johnny gets to do something he likes if he refrains from temper outbursts. Remember, too, that attention can be a powerful reinforcer for unwanted behavior.
- *Punishment* may be tempting, but it is always chancy. In addition, it usually has a bad effect on the relationship between punisher and the person being punished. It is also difficult to employ because, unlike positive reinforcement, punishment must be done with unfailing consistency. If you do decide to punish Johnny for his tantrums, make sure you do so swiftly, certainly, and without undue harshness. As we said earlier, restriction or loss of privileges (negative punishment) is usually more effective than the application of some aversive consequence (positive punishment).
- *Negative reinforcement* has many of the same drawbacks as punishment because it involves unpleasant stimulation. Parents may try—most often unsuccessfully—to use negative reinforcement as a means of encouraging unlikely behavior, such as doing homework, taking out the garbage, or feeding the dog. In its most common form, the parents attempt to use nagging (an aversive stimulus) until the desired behavior occurs, whereupon the nagging presumably stops (negative reinforcement). This tactic rarely works to anyone's satisfaction. (Ironically, Johnny's screaming fit is his own intuitive attempt to manipulate people with negative reinforcement.) The only time negative reinforcement predictably works well is when the aversive conditions were imposed naturally and impersonally—as when you have headache and take aspirin, which produces negative reinforcement when your headache goes away.
- *Extinction* is a guaranteed solution, but only if you control all the reinforcers. In Johnny's case, extinction simply means not giving in to the temper tantrum and not letting him have what he wants (attention or candy, for



example). Instead, you simply allow the tantrum to burn itself out. This may be embarrassing because children often pick the most public places for such displays—a good sign that they are doing so for attention. One big problem with extinction, however, is that it may take a while, so extinction is not a good option if the subject is engaging in dangerous behavior, such as playing in a busy street. Another problem, only recently recognized, is that extinction can unleash a flurry of new trial-and-error behaviors aimed at getting the expected reinforcement (Carpenter, 2001b).

The best approach—often recommended by child psychologists—is to use a combination of tactics. In Johnny’s case, they would probably recommend both reinforcing his desirable behaviors and extinguishing his undesirable ones.

We recommend memorizing the four items on this checklist: positive reinforcement, punishment, negative reinforcement, and extinction. Then, whenever you are dealing with someone whose behavior is undesirable, go through the list and see whether one or more of these operant tactics might do the trick. And remember: The behavior you may want to change could be your own!

## CHECK YOUR UNDERSTANDING

- RECALL:** Thorndike’s *law of effect* said that an organism will learn to perform responses that are
  - preceded by a conditioned stimulus.
  - reflexive.
  - prompted.
  - preceded by a neutral stimulus.
  - rewarded.
- APPLICATION:** Which one of the following is an example of negative reinforcement?
  - taking away a child’s favorite toy when the child misbehaves
  - making a child watch while another child is punished
  - giving a child a toy for misbehaving.
  - going to the dentist and having a toothache relieved
  - spanking a child for swearing
- APPLICATION:** Suppose that you have taught your dog to roll over for the reward of a dog biscuit. Then one day you run out of dog biscuits. Which schedule of reinforcement would keep your dog responding longer without a biscuit?
  - noncontingent reinforcement
  - positive reinforcement.
  - negative reinforcement
  - intermittent reinforcement
  - continuous reinforcement
- RECALL:** Which one of the following is a conditioned reinforcer for most people?
  - a sharp pain in the back
  - water
  - money
  - sex
  - food
- UNDERSTANDING THE CORE CONCEPT:** Operant conditioning, in contrast with classical conditioning, emphasizes events (such as rewards and punishments) that occur
  - after the behavior.
  - concurrently with another response.
  - at the same time as another stimulus.
  - during the behavior.
  - before the behavior.

ANSWERS: 1.e 2.d 3.d 4.c 5.a



## HOW DOES COGNITIVE PSYCHOLOGY EXPLAIN LEARNING?

According to J. D. Watson’s (1968) account in *The Double Helix*, the genetic code was cracked one day in a flash of insight following months of trial and error. You may have had a similar, if less famous, experience when solving a problem of your own. Such insightful events present difficulties for behavioral learning because they are hard to explain in terms of Pavlovian reflexes or Skinnerian shaping.

Many psychologists believe that an entirely different process, called *cognitive learning*, is responsible for such “flashes of insight.” From this perspective, learning does not always show itself immediately in behavior. Instead, learning may be reflected in mental activity alone. And, to the chagrin of behaviorists, the cognitive view maintains that such mental processes can be examined objectively—as the Core Concept for this section says:

According to cognitive psychology, some forms of learning must be explained as changes in mental processes, rather than as changes in behavior alone.



Let’s see how psychologists have approached this task of examining the covert mental processes behind learning. To do so, we first take you on a trip to the Canary Islands, off the coast of northern Africa.

## Insight Learning: Köhler in the Canaries with the Chimps

Isolated on Tenerife in the Canary Islands during World War I, Gestalt psychologist Wolfgang Köhler (*KER-ler*) had time to think long and hard about learning. He was disenchanted with the behaviorists’ explanation for learning, which he found too limiting, and so he sought to develop his own theories. To Köhler’s way of thinking, mental processes had to be an essential component of learning, even though they had been spurned as unscientific speculation by the behaviorists. To press his point, Köhler took advantage of a primate research facility on Tenerife to study chimpanzee behavior in situations that he contrived to make cognitive learning reveal itself (Sharps & Wertheimer, 2000; Sherrill, 1991).

In one famous study, Köhler showed that his chimps could solve complex problems by combining simpler behaviors they had previously learned separately. This was illustrated by Sultan, the brightest chimp, who had learned to pile up boxes and scramble on top of them to reach fruit suspended high in his cage and to use sticks to obtain fruit that was just out of reach. So, when Köhler presented Sultan with a novel situation, fruit suspended even higher in the air, the chimp first attacked it unsuccessfully with sticks, in trial-and-error fashion. In apparent frustration, Sultan eventually threw the sticks away, kicked the wall, and sat down. According to Köhler’s report, the animal then scratched his head and began to stare at some boxes nearby. Suddenly, he jumped up and

### CONNECTION: CHAPTER 4

*Gestalt psychology* is best known for its work on perception.



● The sort of learning displayed by Köhler’s chimps defied explanation by the behaviorists—in terms of classical conditioning and operant conditioning. Here you see Sultan, Köhler’s smartest animal, solving the problem of getting the bananas suspended out of the reach by stacking the boxes and climbing on top of them. Köhler claimed that Sultan’s behavior demonstrated *insight learning*.

dragged a box and a stick underneath the fruit, climbed on the box, and knocked down his prize with the stick. Remarkably, Sultan had never before seen or used this combination of responses. This suggested to Köhler that the animals were not mindlessly using conditioned behaviors but were learning by reorganizing their *perceptions* of problems. He ventured that such behavior shows how apes, like humans, learn to solve problems by suddenly perceiving familiar objects in new forms or relationships—a decidedly mental process, rather than a behavioral one. He called this **insight learning** (Köhler, 1925).

Remarkably, behaviorism had no convincing stimulus–response explanation for Köhler’s demonstration, except to criticize it as poorly controlled. No stretch of the imagination could plausibly explain Sultan’s behavior in stimulus–response terms, as a product merely of classical or operant conditioning. The feats of Köhler’s chimps demanded the cognitive explanation of perceptual reorganization. In a similar fashion, rats in Edward Tolman’s lab began behaving in ways that also flew in the face of accepted behavioral doctrine. Let’s see what they were up to—next.

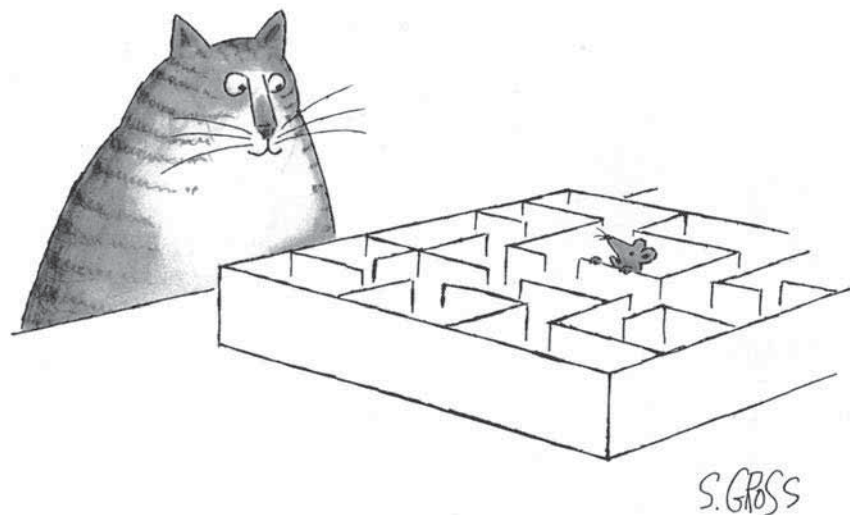
### Cognitive Maps: Tolman Finds Out What’s on a Rat’s Mind

If you have ever given directions to someone or walked through your house in the dark, you have some idea of the *cognitive map* that Edward Tolman (1886–1959) proposed. Technically, a **cognitive map** is a mental image that an organism uses to navigate through a familiar environment. But could such a simple-minded creature as a rat have such complex mental imagery? And, if so, how could the existence of these cognitive maps be demonstrated?

**Mental Images—Not Behaviors** A cognitive map, Tolman argued, was the only way to account for a rat quickly selecting an alternative route in a maze when the preferred path to the goal is blocked. In fact, rats will often select the shortest detour around a barrier, even though taking that particular route was never previously reinforced. Rather than blindly exploring different parts of the maze through trial and error (as would be predicted by behavioral theory), Tolman’s rats behaved as though they had a mental representation of the maze. (Figure 6.8 shows the arrangement of a maze such as Tolman used.)

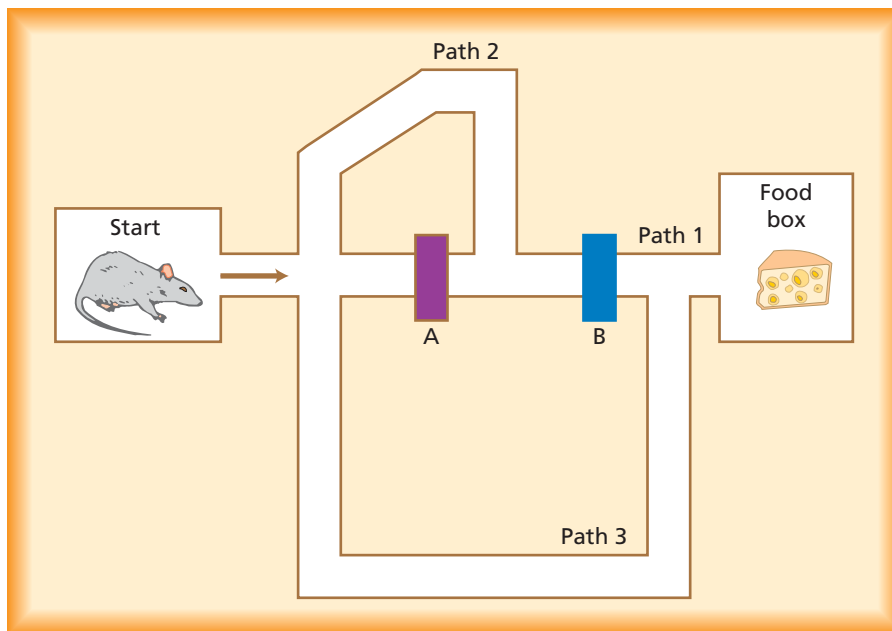
■ **Insight learning** A form of cognitive learning, originally described by the Gestalt psychologists, in which problem solving occurs by means of a sudden reorganization of perceptions.

■ **Cognitive map** A mental representation of physical space.



*“Well, you don’t look like an experimental psychologist to me.”*

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● **FIGURE 6.8** Using Cognitive Maps in Maze Learning

Subjects preferred the direct path (Path 1) when it was open. When it was blocked at A, they preferred Path 2. When Path 2 was blocked at B, rats usually chose Path 3. Their behavior indicated that they had a cognitive map of the best route to the food box.

(Source: From "Degrees of Hunger, Reward and Nonreward, and Maze Learning in Rats" by E. C. Tolman and C. H. Honzik, *University of California Publication of Psychology*, Vol. 4, No. 16, December 1930.)

In further support of his claim that learning was mental, not behavioral, Tolman offered another experiment. After rats had learned to run a maze, he flooded it with water and showed that the rats were quite capable of swimming through the maze. Again, this demonstrated that what the animals had learned were not behaviors. Instead of learning merely a sequence of right and left turns, Tolman argued, they had acquired a more abstract mental representation of the maze's spatial layout (Tolman & Honzik, 1930; Tolman et al., 1946).

**Learning Without Reinforcement** In yet another simple study that attacked the very foundations of behaviorism, Tolman (1948) allowed his rats to wander freely about a maze for several hours, during which they received no reinforcement at all. Yet, despite the lack of reinforcement (which behaviorists supposed to be essential for maze learning), the rats later were able to negotiate the maze for a food reward more quickly than rats that had never seen the maze before. Tolman called this *latent learning*.

**The Significance of Tolman's Work** What made Tolman's work both significant and provocative was its challenge to the prevailing behavioral views of Pavlov, Watson, and (later) Skinner. While Tolman accepted the idea that psychologists must study observable behavior, he showed that simple associations between stimuli and responses could not explain the behavior observed in his experiments. Tolman's cognitive explanations, therefore, presented a daring challenge to behaviorism (Gleitman, 1991; Kesner & Olton, 1990; Olton, 1992; Tolman, 1932). We should note, in passing, that Jean Piaget's work in developmental psychology (which we describe in Chapter 9) was simultaneously challenging behaviorism on another cognitive front.

Subsequent experiments on cognitive maps in rats, chimpanzees, and humans have broadly supported Tolman's work (Menzel, 1978; Moar, 1980; Olton, 1979). More recently, brain imaging has pointed to the hippocampus as a structure involved in "drawing" the cognitive map in the brain (Jacobs & Schenk, 2003). So, it seems clear that Tolman was right: Organisms learn the spatial layout of their environments by exploration, and they do so even if they are not reinforced for exploring. From an evolutionary perspective, this ability





● In the BoBo doll experiment, a boy and girl imitate the aggressive behavior that they have seen an adult exhibit.

■ **Observational learning** A form of cognitive learning in which new responses are acquired after watching others' behavior and the consequences of their behavior.

to make cognitive maps is highly adaptive in animals that must forage for food (Kamil et al., 1987). And, more generally, Tolman seems to have been right about the cognitive underpinnings of behavioral learning.

In the following section we shall see that Albert Bandura has followed in Tolman's footsteps by challenging a pillar of behaviorism. Bandura proposed that rewards can be effective even if we merely see someone else get them. (After all, this is what makes people buy lottery tickets!) Bandura's work, then, suggests that reinforcement can operate indirectly, through *observation*. Let's see how he demonstrated this idea.

## Observational Learning: Bandura's Challenge to Behaviorism

Does observing violent behavior make viewers more likely to become violent? A classic study by Albert Bandura suggests that it does—at least in the children he invited to his lab for a simple experiment. After observing adults seeming to enjoy punching, hitting, and kicking an inflated plastic clown (a BoBo doll), the children later showed similar aggressive behavior toward the doll. Significantly, these children were more aggressive than those in a control condition who had not observed the aggressive models (Bandura et al., 1963). Subsequent studies showed that children will also imitate aggressive behaviors they have seen on film, even when the models were merely cartoon characters.

**Learning by Observation and Imitation** An important implication of Bandura's BoBo doll study is that imitation can serve us in situations where we have not had a chance to gather personal experience. Thus, we learn by imitation or observation, by watching the behavior of another person, or model. If the model's actions appear successful—that is, if the model seems to find it reinforcing—we may seek to behave in the same way. You can think of learning by observation and imitation as an extension of operant conditioning, in which we observe someone else getting rewarded but act as though we had also received a reward.

Psychologists simply call this **observational learning** or *social learning*. It accounts for children learning aggressive behavior by imitating aggressive role models who are perceived as successful or admirable or who seem to be enjoying themselves. And it accounts for changes in clothing fashions and the rapid spread of slang expressions, as well as many other learned behaviors. Observational learning is also seen in nonhuman species, as when a mother cat teaches her kittens how to hunt. One study demonstrated that even a creature as simple-brained as the octopus can learn by example from watching the behavior of other octopi (Fiorito & Scotto, 1992). And, not to be outdone, a clever bowerbird in an Australian national park has achieved some notoriety through observational learning by fooling tourists with its imitation of a cell phone ringing (Winters, 2002).

**Effects of Media Violence** As you might have guessed, much of the research on observational learning has focused on the impact of violence in film and video (Bushman & Anderson, 2001; Huesmann et al., 2003; Johnson et al., 2001). Predictably, the issue is a controversial one (Anderson & Bushman, 2002; Bloom, 2002; Ferguson, 2002; Freedman, 1984, 1996). What we have is *correlational* evidence from more than 50 studies shows that observing violence is associated with violent behavior and more than 100 *experimental* studies pointing to a causal relationship (Huesmann & Moise, 1996; Primavera & Heron, 1996). In addition, we have experimental evidence that viewers of media violence show a reduction in emotional arousal and distress, when they subse-

quently observe violent acts—a condition known as *psychic numbing* (Murray & Kippax, 1979). Finally, notes social psychologist Elliot Aronson, extensive media violence is undoubtedly one factor contributing to violent tragedies, such as the Columbine High School shootings (Aronson, 2000).

Not all imitation is harmful, of course. By imitation we also learn about charitable behavior, comforting others in distress, and driving on the correct side of the road. In general, we can say that people learn much—both prosocial (helping) and antisocial (hurting) behaviors—through observation of others. This capacity to learn from watching enables us to acquire behaviors efficiently, without going through tedious trial and error. So, while observational learning seems to be a factor in violent behavior, it also enables us to learn socially useful behaviors by profiting from the mistakes and successes of others.

## Rethinking Behavioral Learning in Cognitive Terms

In the last few decades of the 20th century, cognitive psychologists ventured deep into the territory of classical and operant conditioning, giving those theories a cognitive tweak (Leslie, 2001). One of the big issues they raised concerns the adaptive value of classical conditioning for an animal (Hollis, 1997). Specifically, Robert Rescorla has shown that the crucial feature of the conditioned stimulus is its *informativeness*—its value in predicting the onset of the unconditioned stimulus (Rescorla, 1972, 1988; Rescorla & Wagner, 1972). We saw this, for example, in food aversions, where a certain taste can serve as a warning of illness.

Research by Leon Kamin extends Rescorla's idea. Kamin (1969) has shown that a learner will form a CS–CR connection only if the CS seems to provide unique information about the UCS. In his laboratory, an aversive unconditioned stimulus, such as a shock, was preceded by multiple warning cues, such as lights, tones, and tastes. Yet, his animal subjects paid attention only to the stimuli that provided the best information about the UCS.

In the wild, the unique wing markings of monarch butterflies serve as conditioned stimuli for butterfly-eating birds that have a learned aversion for monarch butterflies. (They taste awful.) To give a more personal example, you may see smoke as well as smell the acrid odor of something burning before you actually see the flames of a fire. But you may have learned from experience that smoke is not always visible during a fire, whereas the smell of something burning is a telltale sign of fire. The smell then provides better information about whether there is a fire, so you learned to pay closer attention to the smell than to the sight of smoke.

Following the lead of Bandura, Kamin, and Rescorla, attempts are also being made by cognitive psychologists to broaden the scope of operant conditioning to include mental processes (Church, 2001; DeGrandpre, 2000; Ohlsson, 1996). From this perspective, reinforcement changes not only behavior but also the individual's *expectations* for future rewards or punishments in similar situations. An example will probably help: If you are rewarded with a better grade for attending your psychology class, this reward changes your future behavior by changing your expectation that attending future classes will also be rewarding. We will see more of this work in Chapter 14, where we will look at *social cognition*. (See Table 6.3.)

## Brain Mechanisms and Learning

On a neural level, learning apparently involves physical changes that strengthen the synapses in groups of nerve cells—a process called **long-term potentiation** (Antonova et al., 2001; Carlson, 2004; Kandel, 2000). In operant conditioning, the

### ■ Long-term potentiation

A biological process, involving physical changes that strengthen the synapses in groups of nerve cells, which is believed to be the neural basis of learning.

**TABLE 6.3****Behavioral Learning and Cognitive Learning Compared**

Behavioral Learning	Cognitive Learning
Focuses on observable events (stimuli and responses) only	Makes inferences about mental processes that are not directly observable
Learning as associations among stimuli and responses	Learning as information processing: The learner seeks useful information from stimuli
Main forms of learning are habituation, classical conditioning, and operant (instrumental) conditioning	Learning also involves insight, observational learning, cognitive maps, and other more complex forms of learning
Developed as a rebellion against the subjective methods of structuralism and functionalism: Behaviorism became the dominant perspective for much of the 20th century.	Developed as a rebellion against the narrow perspective of behaviorism: Cognitive psychology became the dominant perspective at the end of the 20th century.
Big names: Pavlov, Thorndike, Watson, Skinner	Big names: Köhler, Tolman, Bandura, Rescorla

**CONNECTION: CHAPTER 3**

An *agonist* is a chemical that mimics or enhances the effects of a neurotransmitter.

brain's reward circuitry also comes into play, especially parts of the limbic system and associated brain structures. These circuits are rich in dopamine receptors, leading many experts to believe that this transmitter is crucial to the brain's sensing of reward (Fiorillo et al., 2003; Shizgal & Avanitogiannis, 2003). In support of this view, we remind you that the highly reinforcing sensations produced by cocaine and amphetamines are due to their action as dopamine agonists.

Neuroscientists Eric Kandel and Robert Hawkins (1992) have made a proposal that may connect behavioral learning and cognitive learning at the level of brain pathways. Their theory rests on the discovery that animals with relatively simple nervous systems have a single type of nerve circuit that enables them to learn simple behavioral responses. In the more complex brains of mammals, however, neuroscientists have found a second type of learning circuitry that apparently facilitates higher forms of learning, such as memory for events.

What is the significance of these findings? Kandel and Hawkins speculated that the two types of learning circuits may divide the task of learning along the same line that has long separated behavioral psychologists and cognitive psychologists. Some other psychologists now tentatively agree (Clark & Squire, 1998; Jog et al., 1999). The simpler circuit seems to be responsible for the sort of "mindless" learning that occurs when a dog drools at the sound of a bell or when a person acquires a motor skill, such as riding a bike or swinging a golf club. This kind of learning occurs slowly and improves with repetition over many trials. Significantly, classical conditioning and much of operant learning fit this description. By contrast, the second type of learning circuit seems to be responsible for more complex forms of learning that require conscious processing—the sort of learning that interests cognitive psychologists: concept formation, insight learning, observational learning, and memory for specific events. If further research verifies that this division reflects a fundamental distinction in the nervous system, we will be able to say that those on the behavioral and cognitive extremes were both (partly) right. They were talking about fundamentally different forms of learning.

## "Higher" Cognitive Learning

Whatever the neuroscientists finally decide, it seems clear that the learning required in college classes, where you must learn abstract ideas, is different from the stimulus–response learning that Pavlov, Watson, and Skinner studied. Acquiring knowledge about the field of psychology, for example, involves build-

ing mental images, assimilating concepts, and pondering ways they can be related, compared, and contrasted. By the same token, Sabra's classes taught her *concepts* about flight and about emotional responses. It's not that behavioral conditioning isn't involved in human learning—after all, students *do* work for grades and salivate when they see a pizza—but the principles of behavioral learning don't tell the whole story of “higher” cognitive learning.

The next two chapters will take us deeper into this realm of cognition, where we will discuss memory, thinking, concept formation, problem solving, and intelligence. There you will find out more about the mental structures that underlie cognitive learning. The problem we will face there is exactly the one that the behaviorists were hoping to avoid: In studying cognition, we must make inferences about processes that we cannot measure directly. Cognitive learning is always about processes that are one step removed from observable behavior. We will find, however, that cognitive psychologists have developed some very clever methods for obtaining objective data on which to base their inferences. The newest of these—coming fully on line in the last decade or so—is brain imaging, which, as we will see, has brought psychologists very close to an objective glimpse at private mental processes.

But, before we move on to these topics in the next chapter, let's pause for a critical look at a learning fad that has swept through college classrooms in recent years.



● Learning is not efficient when the learner is “multitasking”—trying to perform several tasks that demand attention at the same time.



## PSYCHOLOGY IN YOUR LIFE: A CRITICAL LOOK AT “LEARNING STYLES”

There is no doubt that people differ in the ways in which they approach learning. You can see by looking at your classmates that everyone brings a different set of interests, abilities, temperamental factors, developmental levels, social and cultural experiences, and emotions to bear on learning tasks. But, can we say that these constitute distinct “learning styles”?

Some educators have made claims about learning styles that go far beyond any supporting evidence (Terry, 2000). For example, much has been made of a supposed difference between “left-brained” and “right-brained” learners. But, as we saw in Chapter 3, this dichotomy is based on a fundamental misinterpretation of split-brain research. (In a person with an intact corpus callosum, both hemispheres work cooperatively.) What the proponents of left-brain/right-brain learning styles usually mean is that some people *prefer* learning verbally, whereas others *prefer* materials that are more visual-spatial. And, like all typologies, this one assumes that people fall neatly into distinct groups, even though it would be more accurate to see people as gradually shading from one end of the spectrum to the other. This questionable assumption may be one reason why little solid evidence exists to show that people who are described as having different learning styles actually do learn differently.

Many other learning-style schemes have been proposed, and with them paper-and-pencil tests have appeared on the market for assessing students' learning styles. Unfortunately, most of these schemes have little supporting data to show that people with different scores learn in different ways. An exception may be an ambitious program developed by Sternberg and Grigorenko to assess students on their abilities for logical, creative, and practical thinking—arguably, three distinct forms of “intelligence” (Sternberg, 1994;



Sternberg & Grigorenko, 1997). Students in an introductory psychology course were divided into groups that received instruction emphasizing the form of intelligence on which they had scored highest. (A control group of students was deliberately mismatched.) Tests at the end of the course indicated that students did best when the teaching emphasis matched their intellectual style. As a practical matter, however, such a fine-tuned approach is probably not feasible for implementation on a large scale.

On a more positive note, interest in learning styles has alerted teachers and professors to the fact that their material can usually be taught in a variety of ways. Further, the available research suggests that everyone learns better when the material can be approached in more than one way—both visual and verbal, as well as through hands-on active learning (see, for example, McKeachie, 1990, 1997, 1999). In recent years, this has led to the development of a variety of teaching methods to augment the lecture-only method that had previously been used extensively in classes.

The practical lesson here is to be skeptical of tests that purport to identify your learning style. Beware also of people who might tell you that you are a visual learner, a reflective learner, or some other such type. This sort of thinking erroneously suggests that each person learns in only one way. It also erroneously suggests that the way we learn is fixed and unchanging. In fact, your college experience presents a wonderful opportunity to learn to think and learn in new and unaccustomed ways.

## CHECK YOUR UNDERSTANDING

1. **RECALL:** When their goal path was blocked, Tolman's rats would take the shortest detour around the barrier. This, said Tolman, showed that they had developed
  - a. observational learning.
  - b. operant behavior.
  - c. trial-and-error learning.
  - d. classical responses.
  - e. cognitive maps.
2. **RECALL:** Cognitive psychologist Robert Rescorla has reinterpreted the process of classical conditioning. In his view, the conditioned stimulus (CS) serves as a
  - a. stimulus that follows the UCS.
  - b. punisher.
  - c. cue that signals the onset of the UCS.
  - d. negative reinforcement.
  - e. cognitive map.
3. **APPLICATION:** If you were going to use Bandura's findings in developing a program to prevent violence among middle school children, you might
  - a. have children role-play nonaggressive solutions to interpersonal problems.
  - b. have children watch videos of aggressive children who are not being reinforced for their aggressive behavior.
  - c. reward children for nonviolent acts.
  - d. punish children for aggressive acts performed at school.
  - e. have children punch a BoBo doll to "get the aggression out of their system."
4. **UNDERSTANDING THE CORE CONCEPT:** Which of the following proved to be difficult to explain in purely behavioral terms?
  - a. a child learning to read
  - b. a pigeon learning to press a lever in a Skinner box for a food reward
  - c. a chimpanzee using a pile of boxes and a stick to obtain food hung high in its cage
  - d. a dog salivating at the sound of a bell
  - e. a trained seal doing a trick for a fish

ANSWERS: 1. e 2. c 3. b 4. c

## LEARNING: THE STATE OF THE ART

Psychologists now understand the essential features of behavioral learning: habituation, classical conditioning, and operant conditioning. Arguably, they know more about such learning than about any other facet of psychology. Is

there anything left to learn about learning? Here are three important frontiers that need much more exploration:

- We know only a little about the neuroscience behind learning: the nerve circuits, the neurotransmitters, and how they represent our experience (Kandel, 2000). At the most basic level, what *is* learning?
- We need more work that bridges the gap between behavioral and cognitive learning. The tools of neuroscience have removed many of the old (and, at the time, valid) objections the behaviorists voiced about the objective study of mental processes. But is cognitive learning just an elaboration of classical conditioning, operant conditioning, and habituation—or is it something fundamentally different?
- Third, we have just scratched the surface in our understanding of how we learn about concepts, ideas, and images. This is not only a theoretical issue but also a question of urgent practical importance: How can we facilitate such learning in our schools and colleges?

Plenty of work on learning remains to be done by a new generation of researchers who can ask the right questions and look beyond the old controversies.

## USING PSYCHOLOGY TO LEARN PSYCHOLOGY

### Operant Conditioning Can Help You Study More—and Enjoy It

You may have tried the Premack principle to trick yourself into studying more, perhaps by denying yourself TV time or a trip to the refrigerator until your homework was done. It works for some people, but if it doesn't work for you, try making the studying itself more enjoyable and more reinforcing.

For most of us, being with people we like is reinforcing, regardless of the activity. So, make some (not all) of your studying a social activity. That is, schedule a time when you and another classmate or two can get together to identify and clarify important concepts and to try to predict what will be on the next test.

Don't focus just on vocabulary. Rather, try to discover the big picture—the overall meaning of each section of the chapter. The Core Concepts are a good place to start. Then you can discuss with your friends how the details fit in with the Core Concepts. You will most likely find that the social pressure of an upcoming study group will help motivate you to get your reading done and identify murky points. When you get together for your group study session, you will find that explaining what you have learned reinforces your own learning. The real reinforcement comes, however, from spending some time—studying—with your friends!

## CHAPTER SUMMARY

Learning produces lasting changes in behavior or mental processes, giving us an advantage over organisms that rely more heavily on reflexes and instincts. Some forms of learning, such as habituation, are quite simple, while others, such as classical conditioning, operant conditioning, and cognitive learning, are more complex.



### • WHAT SORT OF LEARNING DOES CLASSICAL CONDITIONING EXPLAIN?

The earliest learning research focused on classical conditioning, beginning with Ivan Pavlov's discovery that conditioned stimuli (after being paired with unconditioned stimuli) could elicit

reflexive responses. His experiments on dogs showed how conditioned responses could be acquired, extinguished, and undergo spontaneous recovery in laboratory animals. He also demonstrated stimulus generalization and discrimination learning. John Watson extended Pavlov's work to people, notably in his famous experiment on the conditioning of fear in Little Albert. More recent work, particularly studies of taste aversions, suggests, however, that classical conditioning is not a simple stimulus–response learning process but also has a biological component. In general, classical conditioning affects basic, survival-oriented responses. Therapeutic applications of Pavlovian learning include the prevention of harmful food aversions in chemotherapy patients.

- **Classical conditioning is a basic form of learning in which a stimulus that produces an innate reflex becomes associated with a previously neutral stimulus, which then acquires the power to elicit essentially the same response.**

### ● HOW DO WE LEARN NEW BEHAVIORS BY OPERANT CONDITIONING?

A more active form of learning, called instrumental conditioning, was first explored by Edward Thorndike, who established the law of effect, based on his study of trial-and-error learning. B. F. Skinner expanded Thorndike's work, now called operant conditioning, to explain how responses are influenced by their environmental consequences. His work identified and assessed various consequences, including positive and negative reinforcement, punishment, and an operant form of extinction. The power of operant conditioning involves producing new responses. To do so, Skinner and others examined continuous reinforcement, as well as several kinds of intermittent reinforcement contingencies, including FR, VR, FI, and VI schedules.

As for punishment, research has shown that it is more difficult to use than reward because it has several undesirable side effects. There are, however, alternatives, including operant extinction and rewarding of alternative responses, application of the Premack principle, and prompting and shaping new behaviors.

- **In operant conditioning, the consequences of behavior, such as rewards and punishments, influence the chance that the behavior will occur again.**

### ● HOW DOES COGNITIVE PSYCHOLOGY EXPLAIN LEARNING?

Much research now suggests that learning is not just a process that links stimuli and responses: Learning is also cognitive. This was shown in Köhler's work on insight learning in chimpanzees, in Tolman's studies of cognitive maps in rats, and in Bandura's research on observational learning and imitation in humans—particularly the effect of observing aggressive models, which spawned many studies on media violence. All of this cognitive research demonstrated that learning did not necessarily involve changes in behavior nor did it require reinforcement. In the past three decades, cognitive scientists have worked on reinterpreting behavioral learning, especially operant and classical conditioning, in cognitive terms, as well as searching for the neural basis of learning. Some educators have, however, taken new developments in learning far beyond the evidence: Specifically, there is little empirical support for most of the claims in the “learning style” literature.

- **According to cognitive psychology, some forms of learning must be explained as changes in mental processes, rather than as changes in behavior alone.**

## REVIEW TEST

*For each of the following items, choose the single correct or best answer. The correct answers appear at the end.*

1. Which one of the following taught that psychology should involve only the analysis of observable stimuli and responses?
  - a. Albert Bandura
  - b. B. F. Skinner
  - c. Sigmund Freud
  - d. John Garcia
  - e. Wolfgang Köhler
2. According to Thorndike, rewarded responses are gradually “stamped in,” while unrewarded or punished responses are eliminated. He called this
  - a. classical conditioning.
  - b. the law of effect.
  - c. negative punishment.
  - d. observational learning.
  - e. extinction.
3. Which one of the following illustrates a reinforcement contingency?
  - a. When I get home late, dinner is cold.
  - b. Money is reinforcing because it buys me things I need and want, such as food, clothes, and entertainment.
  - c. I get \$500 for a week's work.
  - d. If I don't show up for work, I will be fired.
  - e. I always work harder in the morning than I do in the afternoon.
4. “The best part of going to the beach,” your friend exclaims as you start your vacation, “is getting away from all the stress of work and school.” If this is true, then your friend's vacation-taking behavior has been influenced by
  - a. extinction.
  - b. omission training.
  - c. punishment.
  - d. positive reinforcement.
  - e. negative reinforcement.

5. Which of the following is *not* a good way to make punishment effective?
  - a. Make it swift and brief.
  - b. Focus it on the undesirable behavior.
  - c. Make it intense.
  - d. Deliver it immediately.
  - e. Limit it to the situation in which the response occurred.
6. According to the Premack principle, a reinforcer can be
  - a. the opportunity to engage in any behavior frequently performed by the organism.
  - b. an automatic response to a stimulus.
  - c. anything that rewards rather than penalizes behavior.
  - d. changes in behavior from its past norms.
  - e. a stimulus that becomes associated with an unconditioned stimulus.
7. In his research with rats running mazes, Edward C. Tolman concluded that his animals had
  - a. made a CS–UCS connection.
  - b. utilized positive reinforcement.
  - c. displayed spontaneous recovery.
  - d. adapted to positive and negative reinforcement.
  - e. developed a cognitive map.
8. In Bandura's experiment with the BoBo doll, aggressive behavior resulted from
  - a. observational learning.
  - b. painful stimulation.
  - c. punishment.
  - d. negative reinforcement.
  - e. insults.
9. During classical conditioning, for an organism to learn a conditioned association between two stimuli, the UCS must seem to
  - a. predict the CS.
  - b. mimic the NS.
  - c. be predicted by the CS.
  - d. be independent of the CS.
  - e. follow the UCR.
10. The biggest problem with the concept of "learning styles" is that
  - a. most people are visual learners—hardly anyone is an auditory learner.
  - b. most educators don't believe in learning styles.
  - c. auditory learning styles are underutilized.
  - d. the ways people learn don't fall neatly into distinct learning-style categories.
  - e. people who think with the right brain don't fit into any known learning style.

ANSWERS: 1. b 2. b 3. c 4. e 5. c 6. a 7. e 8. a 9. c 10. d

## KEY TERMS

**Learning** (p. 196)

**Habituation** (p. 197)

**Mere exposure effect** (p. 197)

**Behavioral learning** (p. 198)

**Classical conditioning** (p. 199)

**Neutral stimulus** (p. 199)

**Unconditioned stimulus (UCS)** (p. 199)

**Unconditioned response (UCR)** (p. 199)

**Acquisition** (p. 200)

**Conditioned stimulus (CS)** (p. 200)

**Conditioned response (CR)** (p. 200)

**Extinction (in classical conditioning)** (p. 201)

**Spontaneous recovery** (p. 201)

**Stimulus generalization** (p. 202)

**Stimulus discrimination** (p. 202)

**Experimental neurosis** (p. 202)

**Taste-aversion learning** (p. 204)

**Operant** (p. 206)

**Operant conditioning** (p. 206)

**Law of effect** (p. 206)

**Reinforcer** (p. 206)

**Positive reinforcement** (p. 207)

**Negative reinforcement** (p. 207)

**Operant chamber** (p. 207)

**Reinforcement contingencies** (p. 208)

**Continuous reinforcement** (p. 208)

**Shaping** (p. 208)

**Intermittent reinforcement** (p. 208)

**Extinction (in operant conditioning)** (p. 208)

**Schedules of reinforcement** (p. 209)

**Ratio schedule** (p. 209)

**Interval schedule** (p. 209)

**Fixed ratio (FR) schedules** (p. 209)

**Variable ratio (VR) schedules** (p. 209)

**Fixed interval (FI) schedules** (p. 209)

**Variable interval (VI) schedules** (p. 210)

**Primary reinforcers** (p. 210)

**Conditioned reinforcers** or **secondary reinforcers** (p. 210)

**Token economy** (p. 210)

**Premack principle** (p. 211)

**Punishment** (p. 211)

**Positive punishment** (p. 211)

**Omission training (negative punishment)** (p. 211)

**Insight learning** (p. 220)

**Cognitive map** (p. 220)

**Observational learning** (p. 222)

**Long-term potentiation** (p. 223)



## AP\* REVIEW: VOCABULARY

Match each of the following vocabulary terms to its definition.

- |                              |                            |
|------------------------------|----------------------------|
| 1. Classical conditioning    | 6. Interval schedule       |
| 2. Conditioned stimulus (CS) | 7. Token economy           |
| 3. Spontaneous recovery      | 8. Premack principle       |
| 4. Law of effect             | 9. Omission training       |
| 5. Ratio schedule            | 10. Observational learning |

- \_\_\_\_\_ a. The reappearance of an extinguished conditioned response after a time delay.
- \_\_\_\_\_ b. The concept that a more-preferred activity can be used to reinforce a less-preferred activity.
- \_\_\_\_\_ c. A program by which reinforcement depends on the time elapsed since the last reinforcement.
- \_\_\_\_\_ d. A previously neutral stimulus that comes to elicit the conditioned response.

- \_\_\_\_\_ e. A therapeutic method by which individuals are rewarded with items that serve as secondary reinforcers.
- \_\_\_\_\_ f. A form of cognitive learning in which new responses are acquired after watching others' behavior and the resulting consequences.
- \_\_\_\_\_ g. The idea that responses that produced desirable results would be learned, or "stamped" into the organism.
- \_\_\_\_\_ h. The removal of an appetitive stimulus following a response, which leads to a decrease in behavior.
- \_\_\_\_\_ i. A program by which reinforcement depends on the number of correct responses.
- \_\_\_\_\_ j. A form of behavior learning in which a previously neutral stimulus acquires the power to elicit the same innate reflex produced by another stimulus.

## AP\* REVIEW: ESSAY

Use your knowledge of the chapter concepts to answer the following essay question.

Albert Bandura designed one of the seminal experiments regarding Observational Learning. Support or refute his conclusions regarding children and violence being sure that your argument addresses each of the following:

- a. positive reinforcement
- b. negative reinforcement
- c. punishment
- d. omission training

## OUR RECOMMENDED BOOKS AND VIDEOS

### BOOKS

Artiss, K. L. (1996). *Mistake making*. Lanham, MD: University Press of America. Why doesn't everyone learn from experience? Some experiences may not be memorable—but certain types of people may also have difficulty making the adjustments necessary for each lesson; and, failing to learn, they end up suffering relentless punishment by repeating their errors and failures. Here's why it may happen—and what to do about it.

Greven, P. (1992). *Spare the child: The religious roots of punishment and the psychological impact of child abuse*. New York: Vintage Books. Imagine a world in which hitting a child is not only politically incorrect, it is also against the law of both man and God. Greven documents the great weight of evidence against any rationale for corporal punishment of children and asserts that we have a moral obligation to develop humane alternatives to beating our kids.

Martel, Yann. (2003). *Life of Pi*. Orlando, FL: Harcourt. No, this is not a math book. It's a fantastic (in both senses) novel about religion . . . and animal learning and behavior. Pi is a young boy from India, where his parents own a zoo and where he becomes a Hindu, a Christian, and a Moslem. When the zoo is sold, the family heads to Canada on a steamer, along with many of their animals. A storm sends the ship to the bottom, and the only survivors are Pi, a wounded zebra, a seasick orangutan, a hyena, and Richard Parker, a Bengal tiger—all in the same lifeboat. That's where Pi's deep understanding of animals comes in handy.

Nierenberg, G. I. (1996). *Doing it right the first time: A short guide to learning from your most memorable errors, mistakes, and blunders*. New York: Wiley. Mainly aimed at managers, this book also offers valuable advice to students (and professors) about how to first become aware of and then detect patterns in our own repeated errors. Some strategies involve focusing attention, learning from others' mistakes, and building accuracy.

Wright, J. (2003). *There must be more than this: Finding more life, love, and meaning by overcoming your soft addictions*. New York: Broadway Books. Educator Judith Wright finds that most people indulge—too much—in “soft addictions” such as watching TV, surfing the Net, gossiping, or shopping. Time spent in these tempting but ultimately unfulfilling activities leaves us needier than before. The key to change is in understanding why these time-wasters feel rewarding and how to find positive reinforcement instead in truly meaningful activity such as interacting with friends or completing valued work.

### VIDEOS

*A Clockwork Orange*. (1971, color, 137 min.). Directed by Stanley Kubrick; starring Malcolm McDowell, Patrick Magee, Adrienne Corri. A classic and still powerful rendition of Anthony Burgess's novel about a futuristic society's efforts to reform a psychopathic criminal by applying aversive conditioning—with unexpected results. (Rating R)