

THE WORLD OF PSYCHOLOGY, 5/E

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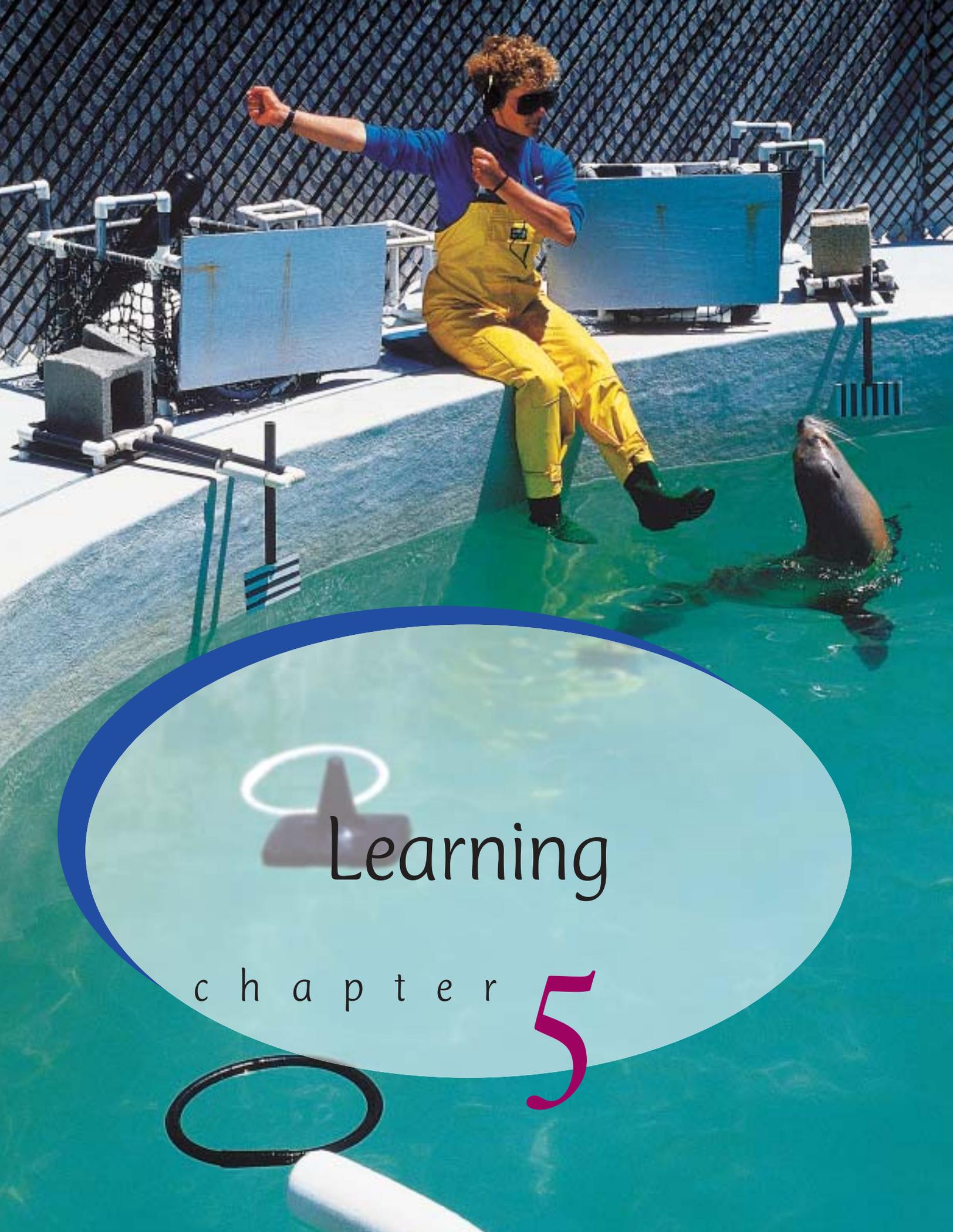
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Learning

chapter 5

Classical Conditioning: The Original View

- *What kind of learning did Pavlov discover?*
- *How is classical conditioning accomplished?*
- *What kinds of changes in stimuli and learning conditions lead to changes in conditioned responses?*
- *How did Watson demonstrate that fear could be classically conditioned?*

Classical Conditioning: The Contemporary View

- *According to Rescorla, what is the critical element in classical conditioning?*

- *What did Garcia and Koelling discover about classical conditioning?*
- *What types of everyday responses can be subject to classical conditioning?*
- *Why doesn't classical conditioning occur every time unconditioned and conditioned stimuli occur together?*

Operant Conditioning

- *What did Thorndike conclude about learning by watching cats try to escape from his puzzle box?*
- *What was Skinner's major contribution to psychology?*

- *What is the process by which responses are acquired through operant conditioning?*
- *What is the goal of both positive reinforcement and negative reinforcement, and how is that goal accomplished with each?*
- *What are the four types of schedules of reinforcement, and which type is most effective?*
- *Why don't consequences always cause changes in behavior?*
- *How does punishment differ from negative reinforcement?*
- *When is avoidance learning desirable, and when is it maladaptive?*
- *What are some applications of operant conditioning?*

Cognitive Learning

- *What is insight, and how does it affect learning?*
- *What did Tolman discover about the necessity of reinforcement?*
- *How do we learn by observing others?*

How do you suppose animal trainers get their "students" to perform unnatural behaviors such as riding a bicycle or jumping through a hoop?

Training a dolphin to leap high in the air might seem to be fairly simple. After all, wild dolphins jump out of the water at times. Of course, they jump when they feel like it, not when another being signals them to do it. To perform the leaping trick, and to learn to do it at the right time, a dolphin has to acquire several skills.

The process begins with relationship building; the dolphin learns to associate the trainer with things it enjoys, such as food, stroking, and

fetching games. These interactions also help the trainer to learn each individual dolphin's personality characteristics: Some enjoy being touched more than playing, some prefer to play "fetch" rather than get stroked, and so on. The pleasant stimuli associated with the trainers serve as potential rewards for desirable behavior.

Once the dolphin is responsive to some kind of reward, a long pole with a float on the end is used to teach it to follow directions. Trainers touch the dolphin with the float and then reward it. Next, the float is placed a few feet from the dolphin. When it swims over and touches the float, a reward is administered. The float is moved farther and farther away from the dolphin until the dolphin has been led to the particular location in the tank where the trainer wants it to begin performing the trick.

The pole-and-float device is then used to teach the dolphin to jump. Remember, it has been rewarded for touching the float. To get the dolphin to jump, the trainer raises the float above the water level. The dolphin jumps up to touch the float and receives its reward. The float is raised a little higher each time, until the animal must jump completely out of the water to receive the reward. The process continues until the dolphin has learned to jump to the desired height.

Suppressing unwanted behaviors is also part of the training process. But the training program cannot include any unpleasant consequences (e.g., beating, electric shocks) because such techniques are regarded as unethical and are forbidden by law in many places. So, to get dolphins to suppress unwanted behaviors, trainers remain completely motionless and silent whenever undesired behaviors occur. This helps the dolphins learn that rewards will be available only after desired behaviors have been performed. The final step in the training process is to teach the dolphin to respond to a unique signal that



The principles of animal training are the same, whether the "students" are marine mammals or dogs.

tells it when to perform the trick. Again, trainers use rewards to teach the dolphin to associate a specific hand gesture or verbal command with the desired behavior.

This process might seem to be very time-consuming, but there is one important shortcut in training dolphins: observational learning. Trainers have found that it is much easier to teach an untrained dolphin to perform desired behaviors when a more experienced dolphin participates in the training. In fact, park-bred babies are usually allowed to accompany their mothers during shows so that they learn all of the show behaviors through observation. Some aspects of training must still be accomplished individually, but, like humans, dolphins appear to have a very great capacity for learning complex behaviors by observing others of their species.

■ **learning**

A relatively permanent change in behavior, knowledge, capability, or attitude that is acquired through experience and cannot be attributed to illness, injury, or maturation.

■ **classical conditioning**

A type of learning through which an organism learns to associate one stimulus with another.

■ **stimulus**

(STIM-yu-lus) Any event or object in the environment to which an organism responds; plural is *stimuli*.

Dolphin training takes advantage of all the principles of learning covered in this chapter. Psychologists define **learning** as a relatively permanent change in behavior, knowledge, capability, or attitude that is acquired through experience and cannot be attributed to illness, injury, or maturation. Several parts of this definition warrant further explanation. First, defining learning as a “relatively permanent change” excludes temporary changes that could result from illness, fatigue, or fluctuations in mood. Second, limiting learning to changes that are “acquired through experience” excludes some readily observable changes in behavior that occur as a result of brain injuries or certain diseases. Also, certain observable changes that occur as individuals grow and mature have nothing to do with learning. For example, technically speaking, infants do not *learn* to crawl or walk. Basic motor skills and the maturational plan that governs their development are a part of the genetically programmed behavioral repertoire of every species. The first kind of learning we’ll consider is classical conditioning.

Classical Conditioning: The Original View

Why do images of Adolf Hitler, the mere mention of the IRS, and the sight of an American flag waving in a gentle breeze evoke strong emotional responses? Each stirs up our emotions because it carries certain associations: Hitler with evil, the IRS with paying taxes, and the American flag with national pride. How do such associations occur? **Classical conditioning** is a type of learning through which an organism learns to associate one stimulus with another. A **stimulus** (the plural is *stimuli*) is any event or object in the environment to which an organism responds. People’s lives are profoundly influenced by the associations learned through classical conditioning, which is sometimes referred to as *respondent conditioning*, or *Pavlovian conditioning*.

Pavlov and Classical Conditioning

Ivan Pavlov (1849–1936) organized and directed research in physiology at the Institute of Experimental Medicine in St. Petersburg, Russia, from 1891 until his death 45 years later. There, he conducted his classic experiments on the physiology of digestion, which won him a Nobel Prize in 1904—the first time a Russian received this honor.

Pavlov’s contribution to psychology came about quite by accident. To conduct his study of the salivary response in dogs, Pavlov made a small inci-

What kind of learning did Pavlov discover?



Ivan Pavlov (1849–1936) earned fame by studying the conditioned reflex in dogs.

sion in the side of each dog's mouth. Then he attached a tube so that the flow of saliva could be diverted from inside the animal's mouth, through the tube, and into a container, where the saliva was collected and measured. Pavlov's purpose was to collect the saliva that the dogs would secrete naturally in response to food placed inside the mouth. But he noticed that, in many cases, the dogs would begin to salivate even before the food was presented. Pavlov observed drops of saliva collecting in the containers when the dogs heard the footsteps of the laboratory assistants coming to feed them. He observed saliva collecting when the dogs heard their food dishes rattling, saw the attendant who fed them, or spotted their food. How could an involuntary response such as salivation come to be associated with the sights and sounds involved in feeding? Pavlov spent the rest of his life studying this question. The type of learning he studied is known today as classical conditioning.

Just how meticulous a researcher Pavlov was is reflected in this description of the laboratory he planned and built in St. Petersburg more than a century ago:

The windows were covered with extra thick sheets of glass; each room had double steel doors which sealed hermetically when closed; and the steel girders which supported the floors were embedded in sand. A deep moat filled with straw encircled the building. Thus, vibration, noise, temperature extremes, odors, even drafts were eliminated. Nothing could influence the animals except the conditioning stimuli to which they were exposed. (Schultz, 1975, pp. 187–188)

The dogs were isolated inside soundproof cubicles and placed in harnesses to restrain their movements. From an adjoining cubicle, an experimenter observed the dogs through a one-way mirror. Food and other stimuli were presented, and the flow of saliva measured by remote control (see Figure 5.1). What did Pavlov and his colleagues learn?

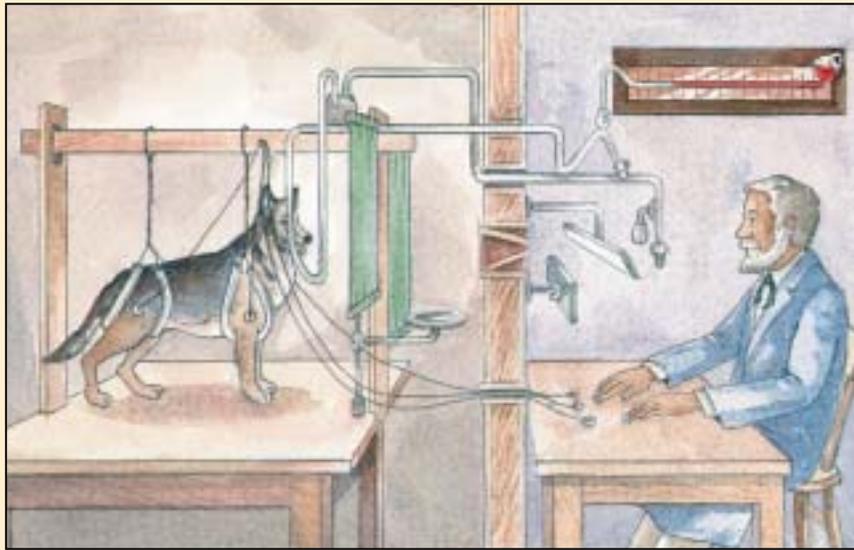
How is classical conditioning accomplished?

The Process of Classical Conditioning

The Reflex A reflex is an involuntary response to a particular stimulus. Two examples are salivation in response to food placed in the mouth and the eyeblink response to a puff of air (Green & Woodruff-Pak, 2000). There are two kinds of reflexes: conditioned and unconditioned. Think of the term *conditioned* as meaning “learned” and the term *unconditioned* as mean-

FIGURE 5.1 The Experimental Apparatus Used in Pavlov's Classical Conditioning Studies

In Pavlov's classical conditioning studies, the dog was restrained in a harness in the cubicle and isolated from all distractions. An experimenter observed the dog through a one-way mirror and, by remote control, presented the dog with food and other conditioning stimuli. A tube carried the saliva from the dog's mouth to a container where it was measured.



ing “unlearned.” Salivation in response to food is an unconditioned reflex because it is an inborn, automatic, unlearned response to a particular stimulus.

When Pavlov observed that his dogs would salivate at the sight of food or the sound of rattling dishes, he realized that this salivation reflex was the result of learning. He called these learned involuntary responses **conditioned reflexes**.

The Conditioned and Unconditioned Stimulus and Response Pavlov (1927/1960) used tones, bells, buzzers, lights, geometric shapes, electric shocks, and metronomes in his conditioning experiments. In a typical experiment, food powder was placed in the dog's mouth, causing salivation. Because dogs do not need to be conditioned to salivate to food, salivation to food is an unlearned response, or **unconditioned response (UR)**. Any stimulus, such as food, that without prior learning will automatically elicit, or bring forth, an unconditioned response is called an **unconditioned stimulus (US)**.

Following is a list of some common unconditioned reflexes, showing their two components: the unconditioned stimulus and the unconditioned response.

UNCONDITIONED REFLEXES

Unconditioned Stimulus (US)
 food
 loud noise
 light in eye
 puff of air in eye

Unconditioned Response (UR)
 salivation
 startle response
 contraction of pupil
 eyeblink response

■ reflex

An involuntary response to a particular stimulus, such as the eyeblink response to a puff of air or salivation when food is placed in the mouth.

■ conditioned reflex

A learned involuntary response.

■ unconditioned response (UR)

A response that is elicited by an unconditioned stimulus without prior learning.

■ unconditioned stimulus (US)

A stimulus that elicits a specific unconditioned response without prior learning.

■ **conditioned stimulus (CS)**

A neutral stimulus that, after repeated pairing with an unconditioned stimulus, becomes associated with it and elicits a conditioned response.

■ **conditioned response (CR)**

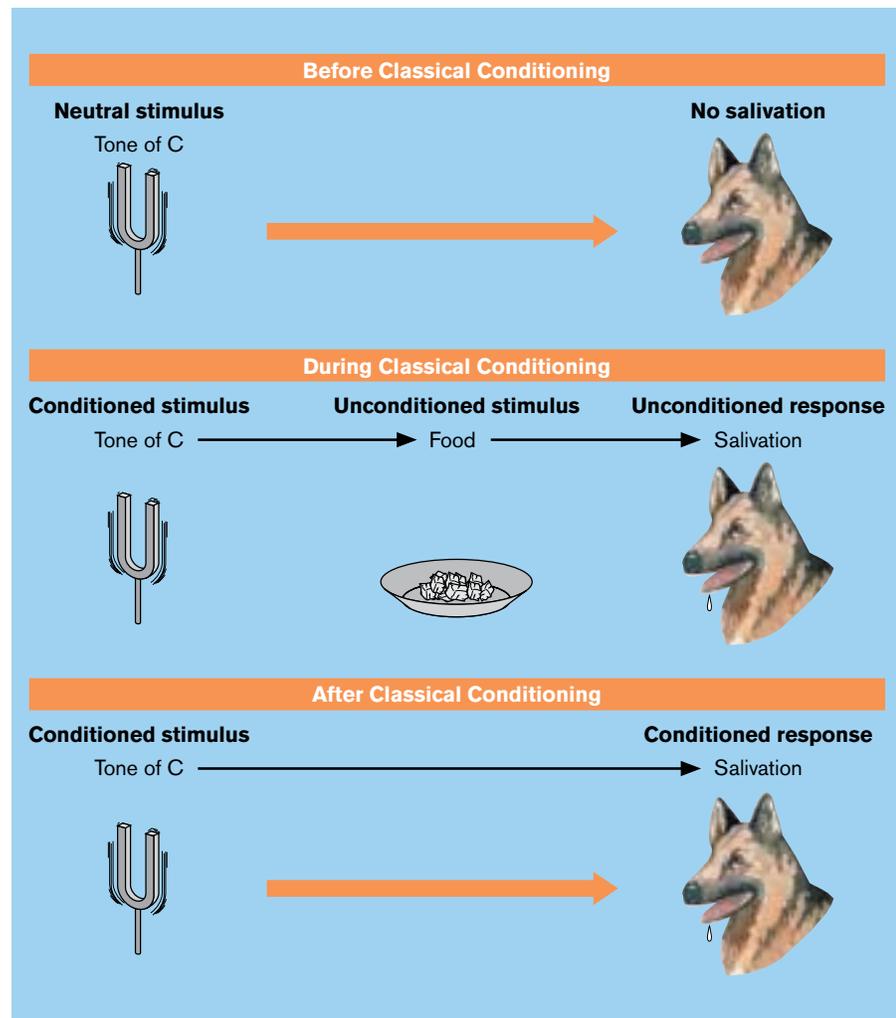
The learned response that comes to be elicited by a conditioned stimulus as a result of its repeated pairing with an unconditioned stimulus.

Pavlov demonstrated that dogs could be conditioned to salivate to a variety of stimuli never before associated with food, as shown in Figure 5.2. During the conditioning process, the researcher would present a neutral stimulus such as a musical tone shortly before placing food powder in the dog's mouth. The food powder would cause the dog to salivate. Pavlov found that after the tone and the food were paired many times, usually 20 or more, the tone alone would elicit salivation (Pavlov, 1927/1960, p. 385). Pavlov called the tone the learned stimulus, or **conditioned stimulus (CS)**, and salivation to the tone the learned response, or **conditioned response (CR)**.

Higher-Order Conditioning Think about what happens when you have to have some kind of blood test. Typically, you sit in a chair next to a table on which are

FIGURE 5.2 Classically Conditioning a Salivation Response

A neutral stimulus (a tone) elicits no salivation until it is repeatedly paired with the unconditioned stimulus (food). After many pairings, the neutral stimulus (now called the conditioned stimulus) alone produces salivation. Classical conditioning has occurred.



arranged materials such as needles, syringes, and such. Next, some kind of constricting device is tied around your arm, and the nurse or technician pats on the surface of your skin until a vein becomes visible. Each step in the sequence tells you that the unavoidable “stick” of the needle and the pain, which is largely the result of reflexive muscle tension, is coming. The stick itself is the unconditioned stimulus, to which you reflexively respond. But all the steps that precede it are conditioned stimuli that cause you to anticipate the pain of the stick itself. And with each successive step, a conditioned response occurs, as your muscles respond to your anxiety by contracting a bit more in anticipation of the stick. When conditioned stimuli are linked together to form a series of signals, a process called **higher-order conditioning** occurs.

■ **higher-order conditioning**
Conditioning that occurs when conditioned stimuli are linked together to form a series of signals.

Changing Conditioned Responses

After conditioning an animal to salivate to a tone, what would happen if you continued to sound the tone but no longer paired it with food? Pavlov found that without the food, salivation to the tone became weaker and weaker and then finally disappeared altogether—a process known as **extinction**. After the response had been extinguished, Pavlov allowed the dog to rest for 20 minutes and then brought it back to the laboratory. He found that the dog would again salivate to the tone. Pavlov called this recurrence **spontaneous recovery**. But the spontaneously recovered response was weaker and shorter in duration than the original conditioned response. Figure 5.3 shows the processes of extinction and spontaneous recovery.

What kinds of changes in stimuli and learning conditions lead to changes in conditioned responses?

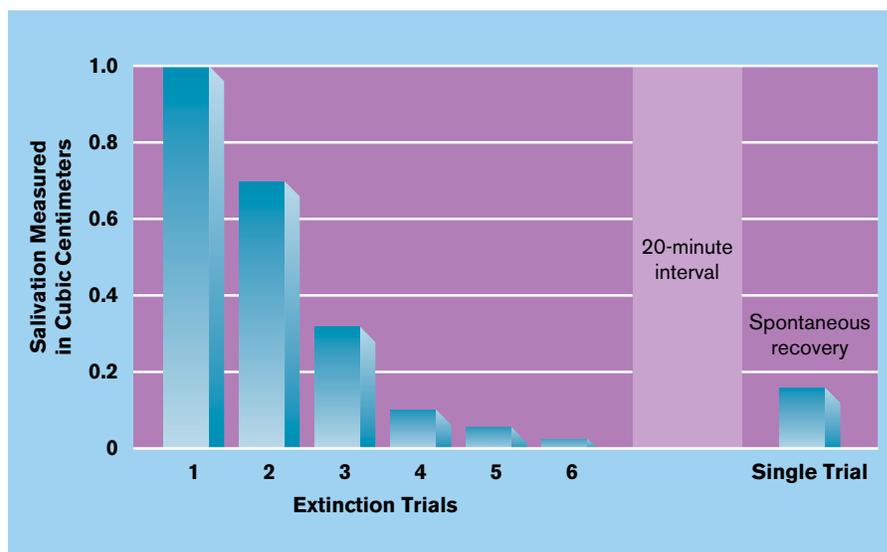
■ **extinction**
In classical conditioning, the weakening and eventual disappearance of the conditioned response as a result of repeated presentation of the conditioned stimulus without the unconditioned stimulus.

■ **spontaneous recovery**
The reappearance of an extinguished response (in a weaker form) when an organism is exposed to the original conditioned stimulus following a rest period.

FIGURE 5.3 Extinction of a Classically Conditioned Response

When a classically conditioned stimulus (a tone) was presented in a series of trials without the unconditioned stimulus (food), Pavlov’s dogs salivated less and less until there was virtually no salivation. But after a 20-minute rest, one sound of the tone caused the conditioned response to reappear in a weakened form (producing only a small amount of salivation), a phenomenon Pavlov called *spontaneous recovery*.

Source: Data from Pavlov (1927/1960), p. 58.





Smell and taste are closely associated because the smell of a particular food is a signal for its taste and the physical sensations associated with eating it. Consequently, a food's odor is a conditioned stimulus that elicits the same emotional and even physiological responses as the food itself. In fact, seeing a photo of someone smelling a particularly pungent food may also act as a conditioned stimulus. When you look at this photo, can you imagine how the peach smells? When you imagine the smell, do you recall the food's taste and texture? Are you starting to get hungry?

Some research indicates that extinction is context-specific (Bouton, 1993; Bouton & Ricker, 1994). When a conditioned response is extinguished in one setting, it can still be elicited in other settings where extinction training has not occurred. Pavlov did not discover this because his experiments were always conducted in the same setting.

Assume that you have conditioned a dog to salivate when it hears the tone middle C played on the piano. Would it also salivate if you played B or D? Pavlov found that a tone similar to the original conditioned stimulus would produce the conditioned response (salivation), a phenomenon called **generalization**. But the salivation decreased the farther the tone was from the original conditioned stimulus, until the tone became so different that the dog would not salivate at all.

Pavlov was able to demonstrate generalization using other senses, such as touch. He attached a small vibrator to a dog's thigh and conditioned the dog to salivate when the thigh was stimulated. Once generalization was established, salivation also occurred when other parts of the dog's body were stimulated. But the farther away the point of stimulation was from the thigh, the weaker the salivation response became (see Figure 5.4).

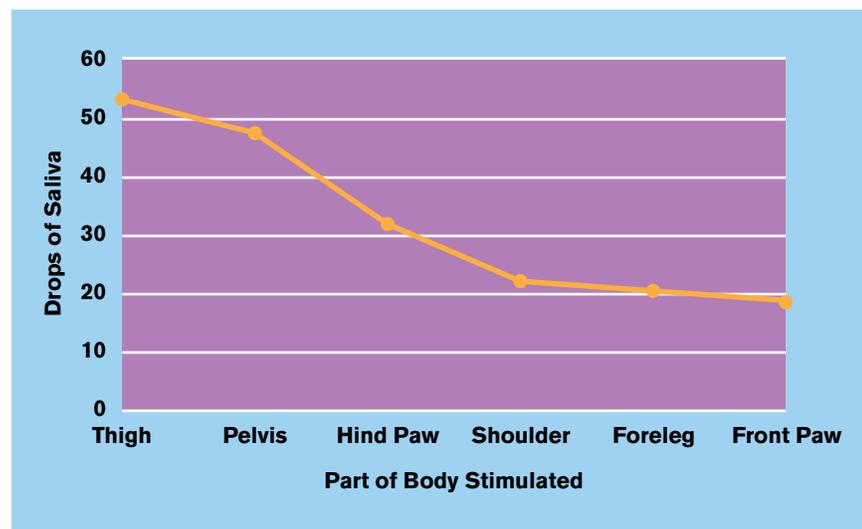
It is easy to see the value of generalization in daily life. For instance, if you enjoyed being in school as a child, you probably feel more positively about your college experiences than your classmates who enjoyed school less. Because of generalization, we do not need to learn a conditioned response to every stimulus that may differ only slightly from an original one. Rather, we learn to approach or avoid a range of stimuli similar to the one that produced the original conditioned response.

Let's return to the example of a dog being conditioned to a musical tone to trace the process of **discrimination**, the learned ability to distinguish between similar stim-

FIGURE 5.4 Generalization of a Conditioned Response

Pavlov attached small vibrators to different parts of a dog's body. After conditioning salivation to stimulation of the dog's thigh, he stimulated other parts of the dog's body. Due to generalization, the salivation also occurred when other body parts were stimulated. But the farther away from the thigh the stimulus was applied, the weaker the salivation response.

Source: From Pavlov (1927/1960).



uli so that the conditioned response occurs only to the original conditioned stimuli but not to similar stimuli.

- Step 1.* The dog is conditioned to salivate in response to the tone C.
- Step 2.* Generalization occurs, and the dog salivates to a range of musical tones above and below C. The dog salivates less and less as the tone moves away from C.
- Step 3.* The original tone C is repeatedly paired with food. Neighboring tones are also sounded, but they are not followed by food. The dog is being conditioned to discriminate. Gradually, the salivation response to the neighboring tones (A, B, D, and E) is extinguished, while salivation to the original tone C is strengthened.

Like generalization, discrimination has survival value. Discriminating between the odors of fresh and spoiled milk will spare you an upset stomach. Discriminating between a rattlesnake and a garter snake could save your life.

■ **generalization**

In classical conditioning, the tendency to make a conditioned response to a stimulus that is similar to the original conditioned stimulus.

■ **discrimination**

The learned ability to distinguish between similar stimuli so that the conditioned response occurs only to the original conditioned stimulus but not to similar stimuli.

John Watson and Emotional Conditioning

In 1919, John Watson (1878–1958) and his assistant, Rosalie Rayner, conducted a now-famous study to prove that fear could be classically conditioned. The subject of the study, known as Little Albert, was a healthy and emotionally stable 11-month-old infant. When tested, he showed no fear except of the loud noise Watson made by striking a hammer against a steel bar near his head.

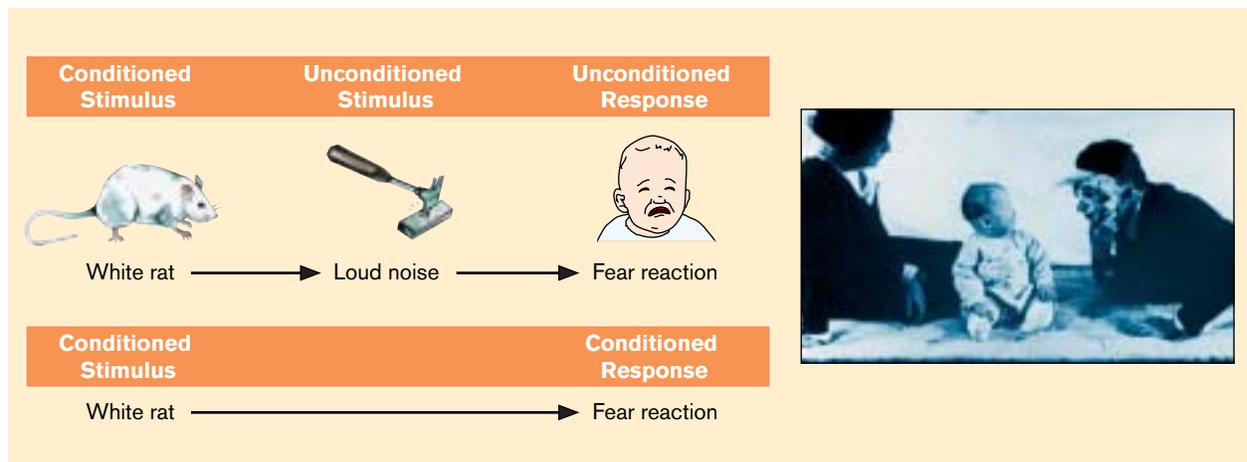
In the laboratory, Rayner presented Little Albert with a white rat. As Albert reached for the rat, Watson struck the steel bar with a hammer just behind Albert's head. This procedure was repeated, and Albert "jumped violently, fell forward and began to whimper" (Watson & Rayner, 1920, p. 4). A week later, Watson continued the experiment, pairing the rat with the loud noise five more times. Then, at the sight of the white rat alone, Albert began to cry.

When Albert returned to the laboratory 5 days later, the fear had generalized to a rabbit and, somewhat less, to a dog, a seal coat, Watson's hair, and a Santa Claus mask (see Figure 5.5). After 30 days, Albert made his final visit to the laboratory. His fears were still

How did Watson demonstrate that fear could be classically conditioned?

FIGURE 5.5 The Conditioned Fear Response

Little Albert's fear of a white rat was a conditioned response that was generalized to other stimuli, including a rabbit and, to a lesser extent, a Santa Claus mask.



evident, although they were somewhat less intense. Watson concluded that conditioned fears “persist and modify personality throughout life” (Watson & Rayner, 1920, p. 12).

Although Watson had formulated techniques for removing conditioned fears, Albert moved out of the city before they could be tried on him. Since Watson apparently knew that Albert would be moving away before these fear-removal techniques could be applied, he clearly showed a disregard for the child’s welfare. The American Psychological Association now has strict ethical standards for the use of human and animal participants in research experiments and would not sanction an experiment such as Watson’s.

Some of Watson’s ideas for removing fears laid the groundwork for certain behavior therapies used today. Three years after his experiment with Little Albert, Watson and a colleague, Mary Cover Jones (1924), found 3-year-old Peter, who, like Albert, was afraid of white rats. He was also afraid of rabbits, a fur coat, feathers, cotton, and a fur rug. Peter’s fear of the rabbit was his strongest fear, and this became the target of Watson’s fear-removal techniques. Peter was brought into the laboratory, seated in a high chair, and given candy to eat. A white rabbit in a wire cage was brought into the room but kept far enough away from Peter that it would not upset him. Over the course of 38 therapy sessions, the rabbit was brought closer and closer to Peter, who continued to enjoy his candy. Occasionally, some of Peter’s friends were brought in to play with the rabbit at a safe distance from Peter so that he could see firsthand that the rabbit did no harm. Toward the end of Peter’s therapy, the rabbit was taken out of the cage and eventually put in Peter’s lap. By the final session, Peter had grown fond of the rabbit. What is more, he had lost all fear of the fur coat, cotton, and feathers, and he could tolerate the white rats and the fur rug.

So far, we have considered classical conditioning primarily in relation to Pavlov’s dogs and Watson’s human subjects. How is classical conditioning viewed today?

Remember It 5.1

1. Classical conditioning was discovered by _____.
2. A dog’s salivation in response to a musical tone is a(n) _____ response.
3. The weakening of a conditioned response that occurs when a conditioned stimulus is presented without the unconditioned stimulus is called _____.
4. Five-year-old Mia was bitten by her grandmother’s labrador retriever. She won’t go near that dog but seems to have no fear of other dogs, even other labradors. Her behavior is best explained by the principle of _____.
5. For _____ conditioning to occur, conditioned stimuli are linked together to form a series of signals.
6. In Watson’s experiment with Little Albert, the white rat was the _____ stimulus, and Albert’s crying when the hammer struck the steel bar was the _____ response.
7. Albert’s fear of the white rat transferred to a rabbit, a dog, a fur coat, and a mask, in a learning process known as _____.

ANSWERS: 1. Pavlov; 2. conditioned; 3. extinction; 4. discrimination; 5. higher-order; 6. conditioned, unconditioned; 7. generalization

Classical Conditioning: The Contemporary View

Which aspect of the classical conditioning process is most important? Pavlov believed that the critical element in classical conditioning was the repeated pairing of the conditioned stimulus and the unconditioned stimulus, with only a brief interval between

the two. Beginning in the late 1960s, though, researchers began to discover exceptions to some of the general principles Pavlov had identified.

The Cognitive Perspective

Robert Rescorla (1967, 1968, 1988; Rescorla & Wagner, 1972) is largely responsible for changing how psychologists view classical conditioning. Rescorla was able to demonstrate that the critical element in classical conditioning is not the repeated pairing of the conditioned stimulus and the unconditioned stimulus. Rather, the important factor is whether the conditioned stimulus provides information that enables the organism to reliably *predict* the occurrence of the unconditioned stimulus. How was Rescorla able to prove that prediction is the critical element?

Using rats as his subjects, Rescorla used a tone as the conditioned stimulus and a shock as the unconditioned stimulus. For one group of rats, the tone and shock were paired 20 times—the shock always occurred during the tone. The other group of rats also received a shock 20 times while the tone was sounding, but this group also received 20 shocks that were not paired with the tone. If the only critical element in classical conditioning were the number of pairings of the conditioned stimulus and the unconditioned stimulus, both groups of rats should have developed a conditioned fear response to the tone, because both groups experienced exactly the same number of pairings of tone and shock. But this was not the case. Only the first group, for which the tone was a reliable predictor of the shock, developed the conditioned fear response to the tone. The second group showed little evidence of conditioning, because the shock was just as likely to occur without the tone as with it. In other words, for this group, the tone provided no additional information about the shock.

But what about Pavlov's belief that almost any neutral stimulus could serve as a conditioned stimulus? Later research revealed that organisms' biological predispositions can limit the associations they can form through classical conditioning.

Biological Predispositions

Remember that Watson conditioned Little Albert to fear the white rat by pairing the presence of the rat with the loud noise of a hammer striking against a steel bar. Do you think Watson could just as easily have conditioned a fear response to a flower or a piece of ribbon? Probably not. Research has shown that humans are more easily conditioned to fear stimuli, such as snakes, that can have very real negative effects on their well-being (Ohman & Mineka, 2003). Moreover, fear of snakes and other potentially threatening animals is just as common in apes and monkeys as in humans, suggesting a biological predisposition to develop these fearful responses.

According to Martin Seligman (1972), most common fears “are related to the survival of the human species through the long course of evolution” (p. 455). Seligman (1970) has suggested that humans and other animals are prepared to associate only certain stimuli with particular consequences. One example of this preparedness is the tendency to develop **taste aversions**—the intense dislike and/or avoidance of particular foods that have been associated with nausea or discomfort.

Experiencing nausea and vomiting after eating a certain food is often enough to condition a long-lasting taste aversion. Taste aversions can be classically conditioned when the delay between the conditioned stimulus (food or drink) and the unconditioned stimulus (nausea) is as long as 12 hours. Researchers believe that many taste aversions begin when children are between 2 and 3 years old, so adults may not remember how their particular aversions originated (Rozin & Zellner, 1985).

In a classic study on taste aversion, Garcia and Koelling (1966) exposed rats to a three-way conditioned stimulus: a bright light, a clicking noise, and flavored water.

According to Rescorla, what is the critical element in classical conditioning?

What did Garcia and Koelling discover about classical conditioning?

■ **taste aversion**

The intense dislike and/or avoidance of a particular food that has been associated with nausea or discomfort.



Chemotherapy treatments can result in a conditioned taste aversion, but providing patients with a “scapegoat” target for the taste aversion can help them maintain a proper diet.

For one group of rats, the unconditioned stimulus was being exposed to either X-rays or lithium chloride, either of which produces nausea and vomiting several hours after exposure; for the other group, the unconditioned stimulus was an electric shock to the feet. The rats that were made ill associated the flavored water with the nausea and avoided it at all times, but they would still drink unflavored water when the bright light and the clicking sound were present. The rats receiving the electric shock continued to prefer the flavored water over unflavored water, but they would not drink at all in the presence of the bright light or the clicking sound. The rats in one group associated nausea only with the flavored water; those in the other group associated electric shock only with the light and the sound.

Garcia and Koelling’s research established two exceptions to traditional ideas of classical conditioning. First, the finding that rats formed an association

between nausea and flavored water ingested several hours earlier contradicted the principle that the conditioned stimulus must be presented shortly before the unconditioned stimulus. Second, the finding that rats associated electric shock only with noise and light and nausea only with flavored water revealed that animals are apparently biologically predisposed to make certain associations and that associations cannot be readily conditioned between just any two stimuli.

Other research on conditioned taste aversions has led to the solution of such practical problems as controlling predators and helping cancer patients. Gustavson and others (1974) used taste aversion conditioning to stop wild coyotes from attacking lambs in the western United States. They set out lamb flesh laced with lithium chloride, a poison that made the coyotes extremely ill but was not fatal. The plan was so successful that after one or two experiences, the coyotes would get sick even at the sight of a lamb.

Knowledge about conditioned taste aversion is useful in solving other problems as well. Bernstein and others (1982; Bernstein, 1985) devised a technique to help cancer patients avoid developing aversions to desirable foods. A group of cancer patients were given a novel-tasting, maple-flavored ice cream before chemotherapy. The nausea caused by the treatment resulted in a taste aversion to the ice cream. The researchers found that when an unusual or unfamiliar food becomes the “scapegoat,” or target for a taste aversion, other foods in the patient’s diet may be protected, and the patient will continue to eat them regularly. So, cancer patients should refrain from eating preferred or nutritious foods prior to chemotherapy. Instead, they should be given an unusual-tasting food shortly before treatment. As a result, they are less likely to develop aversions to foods they normally eat and, in turn, are more likely to maintain their body weight during treatment.

Classical Conditioning in Everyday Life

Do certain songs have special meaning because they remind you of a current or past love? Do you find the scent of a particular perfume or after-shave pleasant or unpleasant because it reminds you of a certain person? Many of our emotional responses, whether positive or negative, result from classical conditioning. Clearly, classical conditioning is an important, even essential, component of the array of learning capacities characteristic of humans. Indeed, recent research suggests that the inability to acquire classically conditioned responses may be the first sign of Alzheimer’s disease, a sign that appears prior to any memory loss (Woodruff-Pak, 2001).

What types of everyday responses can be subject to classical conditioning?

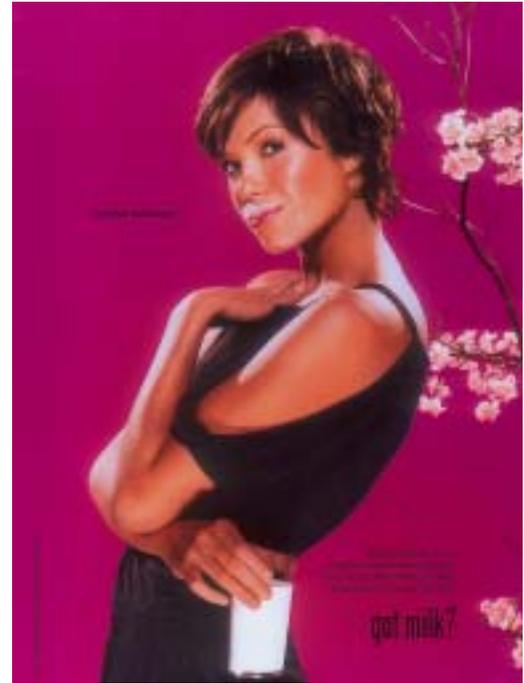
You may have a fear or phobia that was learned through classical conditioning. For example, many people who have had painful dental work develop a dental phobia. Not only do they come to fear the dentist's drill, but they develop anxiety in response to a wide range of stimuli associated with it—the dental chair, the waiting room, even the building where the dentist's office is located. In the conditioning of fear, a conditioned stimulus (CS), such as a tone, is paired with an aversive stimulus (US), such as a foot shock, in a new or unfamiliar environment (context). After just one pairing, an animal exhibits a long-lasting fear of the CS and of the context.

Through classical conditioning, environmental cues associated with drug use can become conditioned stimuli and later produce the conditioned responses of drug craving (Field & Duka, 2002; London et al., 2000). The conditioned stimuli associated with drugs become powerful, often irresistible forces that lead individuals to seek out and use those substances (Porrino & Lyons, 2000). Consequently, drug counselors strongly urge recovering addicts to avoid any cues (people, places, and things) associated with their past drug use. Relapse is far more common in those who do not avoid such associated environmental cues.

Advertisers seek to classically condition consumers when they show products being used by great-looking models or celebrities or in situations where people are enjoying themselves. Advertisers reason that if the “neutral” product is associated with people, objects, or situations consumers particularly like, in time the product will elicit a similarly positive response. Pavlov found that presenting the tone just before the food was the most efficient way to condition salivation in dogs. Television advertisements, too, are most effective when the products are presented before the beautiful people or situations are shown (van den Hout & Merckelbach, 1991).

Research indicates that even the immune system is subject to classical conditioning (Ader, 1985; Ader & Cohen, 1982, 1993; Exton et al., 2000). In the mid-1970s, Robert Ader was conducting an experiment with rats, conditioning them to avoid saccharin-sweetened water. Immediately after drinking the sweet water (which rats consider a treat), the rats were injected with a tasteless drug (cyclophosphamide) that causes severe nausea. The conditioning worked, and from that time on, the rats would not drink the sweet water, with or without the drug. Attempting to reverse the conditioned response, Ader force-fed the sweet water to the rats for many days; later, unexpectedly, many of them died. Ader was puzzled, because the sweet water was in no way lethal. When he checked further into the properties of the tasteless drug, he learned that it suppresses the immune system. A few doses of an immune-suppressing drug paired with sweetened water had produced a conditioned response. As a result, the sweet water alone continued to suppress the immune system, causing the rats to die. Ader and Cohen (1982) successfully repeated the experiment, with strict controls to rule out other explanations. The fact that a neutral stimulus such as sweetened water can produce effects similar to those of an immune-suppressing drug shows how powerful classical conditioning can be.

Bovbjerg and others (1990) found that in some cancer patients undergoing chemotherapy, environmental cues in the treatment setting (context) eventually came to elicit nausea and immune suppression. These were the same conditioned responses that the treatment alone had caused earlier. Other researchers showed that classical conditioning could be used to suppress the immune system in order to prolong the survival of mice heart tissue transplants (Grochowicz et al., 1991). And not only can classically conditioned stimuli suppress the immune system, they can also be used to boost it (Exton et al., 2000; Markovic et al., 1993).



Classical conditioning has proved to be a highly effective tool for advertisers. Here, a neutral product (milk) is paired with an image of an attractive celebrity.

Neurological Basis of Classical Conditioning An intact amygdala is required for the conditioning of fear in both humans and animals, and context fear conditioning also depends on the hippocampus (Anagnostaras et al., 2000; Cheng et al., 2003). Research clearly indicates that the cerebellum is the essential brain structure for motor (movement) conditioning and also the storage site for the memory traces formed during such conditioning (Steinmetz, 2000; Thompson et al., 2000).

Factors Influencing Classical Conditioning

In summary, four major factors facilitate the acquisition of a classically conditioned response:

1. *How reliably the conditioned stimulus predicts the unconditioned stimulus.* Rescorla (1967, 1988) has shown that classical conditioning does not occur automatically just because a neutral stimulus is repeatedly paired with an unconditioned stimulus. The neutral stimulus must also reliably predict the occurrence of the unconditioned stimulus. A tone that is always followed by food will elicit more salivation than one that is followed by food only some of the time.
2. *The number of pairings of the conditioned stimulus and the unconditioned stimulus.* In general, the greater the number of pairings, the stronger the conditioned response. But one pairing is all that is needed to classically condition a taste aversion or a strong emotional response to cues associated with some traumatic event, such as an earthquake or rape.
3. *The intensity of the unconditioned stimulus.* If a conditioned stimulus is paired with a very strong unconditioned stimulus, the conditioned response will be stronger and will be acquired more rapidly than if the conditioned stimulus were paired with a weaker unconditioned stimulus (Gormezano, 1984). For example, striking the steel bar with the hammer produced stronger and faster conditioning in Little Albert than if Watson had merely clapped his hands behind Albert's head.
4. *The temporal relationship between the conditioned stimulus and the unconditioned stimulus.* Conditioning takes place fastest if the conditioned stimulus occurs shortly before the unconditioned stimulus. It takes place more slowly or not at all when the two stimuli occur at the same time. Conditioning rarely takes place when the conditioned stimulus follows the unconditioned stimulus (Gallistel & Gibbon, 2000; Spetch et al., 1981; Spooner & Kellogg, 1947). The ideal time between presentation of conditioned and unconditioned stimuli is about 1/2 second, but this varies according to the type of response being conditioned and the nature and intensity of the conditioned stimulus and the unconditioned stimulus (see Wasserman & Miller, 1997).

Why doesn't classical conditioning occur every time unconditioned and conditioned stimuli occur together?

Remember It 5.2

1. According to Rescorla, the most critical element in classical conditioning is _____.
2. Garcia and Koelling's research suggests that classical conditioning is influenced by _____.
3. Conditioning of a _____ contradicts the general principle of classical conditioning that the unconditioned stimulus should occur immediately _____ after the conditioned stimulus and the two should be paired repeatedly.
4. In everyday life, _____ and _____ are often acquired through classical conditioning.
5. Classical conditioning can suppress or boost the _____.

ANSWERS: 1. prediction; 2. biological predispositions; 3. taste aversion; 4. fears, phobias; 5. immune system

Operant Conditioning

Understanding the principles of classical conditioning can provide a great deal of insight into human behavior. But is there more to human learning than simply responding reflexively to stimuli? Think about a ringing telephone, for example. Do you respond to this stimulus because it has been paired with a natural stimulus of some kind or because of a consequence you anticipate when you hear it? The work of two psychologists, Edward L. Thorndike and B. F. Skinner, helps answer this question.

Thorndike and the Law of Effect

Have you ever watched a dog learn how to turn over a trash can, or a cat learn how to open a door? If so, you probably observed the animal fail several times before finding just the right physical technique for accomplishing the goal. According to American psychologist Edward Thorndike (1874–1949), **trial-and-error learning** is the basis of most behavioral changes. Based on his observations of animal behavior, Thorndike formulated several laws of learning, the most important being the law of effect (Thorndike, 1911/1970). The **law of effect** states that the consequence, or effect, of a response will determine whether the tendency to respond in the same way in the future will be strengthened or weakened. Responses closely followed by satisfying consequences are more likely to be repeated. Thorndike (1898) insisted that it was “unnecessary to invoke reasoning” to explain how the learning took place.

In Thorndike’s best-known experiments, a hungry cat was placed in a wooden box with slats, which was called a *puzzle box*. The box was designed so that the animal had to manipulate a simple mechanism—pressing a pedal or pulling down a loop—to escape and claim a food reward that lay just outside the box. The cat would first try to squeeze through the slats; when these attempts failed, it would scratch, bite, and claw the inside of the box. In time, the cat would accidentally trip the mechanism, which would open the door. Each time, after winning freedom and claiming the food reward, the cat was returned to the box. After many trials, the cat learned to open the door almost immediately after being placed in the box.

Thorndike’s law of effect was the conceptual starting point for B. F. Skinner’s work in operant conditioning.

B. F. Skinner: A Pioneer in Operant Conditioning

Most people in the United States know something about B. F. Skinner because his ideas about learning have strongly influenced American education, parenting practices, and approaches to business management. As a boy growing up in Susquehanna, Pennsylvania, Burrhus Frederic Skinner (1904–1990) became fascinated at an early age by the complex tricks he saw trained pigeons perform at country fairs. He was also interested in constructing mechanical devices and in collecting an assortment of animals, which he kept as pets. These interests were destined to play a major role in his later scientific achievements (Bjork, 1993).

After a failed attempt at becoming a writer following his graduation from college, Skinner began reading the books of Pavlov and Watson. He became so intrigued that he entered graduate school at Harvard and completed his Ph.D. in psychology in 1931. Like Watson before him, Skinner believed that the causes of behavior are in the environment and are not rooted in inner mental events such as thoughts, feelings, or perceptions. Instead, Skinner claimed that these inner mental events are themselves behaviors and, like any other behaviors, are shaped and determined by environmental forces.

Skinner conducted much of his research in operant conditioning at the University of Minnesota in the 1930s and wrote *The Behavior of Organisms* (1938), now a classic.

What did Thorndike conclude about learning by watching cats try to escape from his puzzle box?

■ trial-and-error learning

Learning that occurs when a response is associated with a successful solution to a problem after a number of unsuccessful responses.

What was Skinner’s major contribution to psychology?

■ law of effect

One of Thorndike’s laws of learning, which states that the consequence, or effect, of a response will determine whether the tendency to respond in the same way in the future will be strengthened or weakened.

Gaining more attention was his first novel, *Walden Two* (1948b), set in a fictional utopian community where reinforcement principles are used to produce happy, productive, and cooperative citizens. In 1948, Skinner returned to Harvard and continued his research and writing. There, he wrote *Science and Human Behavior* (1953), which provides a description of the process of operant conditioning.

In a later and highly controversial book, *Beyond Freedom and Dignity* (1971), Skinner was critical of society's preoccupation with the notion of freedom. He maintained that free will is a myth and that a person's behavior is always shaped and controlled by others—parents, teachers, peers, advertising, television. He argued that rather than leaving the control of human behavior to chance, societies should systematically shape the behavior of their members for the larger good.

Although Skinner's social theories generated controversy, little controversy exists about the significance of his research in operant conditioning.

The Process of Operant Conditioning

Most of us know that we learn from consequences, but what is the actual process involved in such learning? In **operant conditioning**, the consequences of behavior are manipulated in order to increase or decrease the frequency of an existing response or to shape an entirely new response. Behavior that is reinforced—that is, followed by rewarding consequences—tends to be repeated. A **reinforcer** is anything that strengthens or increases the probability of the response it follows.

Operant conditioning permits the learning of a broad range of new responses. For example, humans can learn to modify their brain-wave patterns through operant conditioning if they are given immediate positive reinforcement for the brain-wave changes that show the desired direction. Such operantly conditioned changes can result in better performance on motor tasks and faster responses on a variety of cognitive tasks (Pulvermüller et al., 2000).

Shaping Behavior In the description of dolphin training at the beginning of the chapter, you learned that the tricks are learned in small steps rather than all at once, an operant conditioning technique called **shaping**. B. F. Skinner demonstrated that shaping is particularly effective in conditioning complex behaviors. With shaping, rather than waiting for the desired response to occur and then reinforcing it, a researcher (or parent or animal trainer) reinforces any movement in the direction of the desired response, thereby gradually guiding the responses toward the ultimate goal.

Skinner designed a soundproof apparatus, commonly called a **Skinner box**, with which he conducted his experiments in operant conditioning. One type of box is equipped with a lever, or bar, that a rat presses to gain a reward of food pellets or water from a dispenser. A record of the animal's bar pressing is registered on a device called a *cumulative recorder*, also invented by Skinner. Through the use of shaping, a rat in a Skinner box is conditioned to press a bar for rewards. It may be rewarded first for simply turning toward the bar. The next reward comes only when the rat moves closer to the bar. Each step closer to the bar is rewarded. Next, the rat must touch the bar to receive a reward; finally, it is rewarded only when it presses the bar.

Shaping—rewarding **successive approximations** of the desired response—has been used effectively to condition complex behaviors in people as well as other animals. Parents may use shaping to help their children develop good table manners, praising them each time they show an improvement. Teachers often use shaping with disruptive children, reinforcing them at first for very short periods of good behavior and then gradually expecting them to work productively for longer and longer periods. Through shaping, circus animals have learned to perform a wide range of amazing feats, and pigeons have learned to bowl and play Ping-Pong.

What is the process by which responses are acquired through operant conditioning?

■ operant conditioning

A type of learning in which the consequences of behavior are manipulated in order to increase or decrease the frequency of an existing response or to shape an entirely new response.

■ reinforcer

Anything that follows a response and strengthens it or increases the probability that it will occur.

■ shaping

An operant conditioning technique that consists of gradually molding a desired behavior (response) by reinforcing any movement in the direction of the desired response, thereby gradually guiding the responses toward the ultimate goal.

■ Skinner box

A soundproof chamber with a device for delivering food to an animal subject; used in operant conditioning experiments.

■ successive approximations

A series of gradual steps, each of which is more similar to the final desired response.

Of course, the motive of the shaper is very different from that of the person or animal whose behavior is being shaped. The shaper seeks to change another's behavior by controlling its consequences. The motive of the person or animal whose behavior is being shaped is to gain rewards or avoid unwanted consequences.

Superstitious Behavior Why do athletes develop habits such as wearing their “lucky socks” whenever they play? Sometimes a reward follows a behavior, but the two are not related. Superstitious behavior occurs if an individual falsely believes that a connection exists between an act and its consequences. A gambler in Las Vegas blows on the dice just before he rolls them and wins \$1,000. On the next roll, he follows the same ritual and wins again. Although a rewarding event follows the ritual of blowing on the dice, the gambler should not assume a connection between the two.

Superstitious behavior is not confined to humans. Skinner (1948a) developed superstitious behavior in pigeons by giving food rewards every 15 seconds regardless of the pigeons' behavior. Whatever response the pigeons happened to be making was reinforced, and before long, each pigeon developed its own ritual, such as turning counterclockwise in the cage several times or making pendulum movements with its head.

Extinction What happens when reinforcement is no longer available? In operant conditioning, **extinction** occurs when reinforcers are withheld. A rat in a Skinner box will eventually stop pressing a bar when it is no longer rewarded with food pellets.

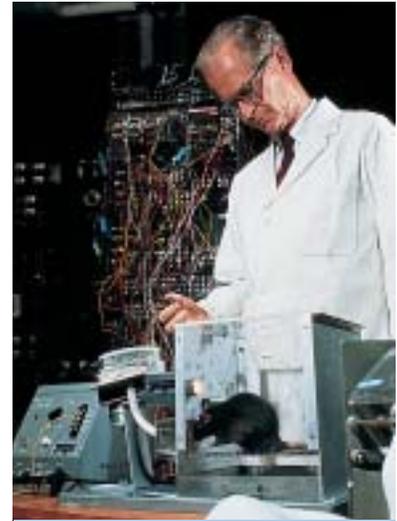
In humans and other animals, the withholding of reinforcement can lead to frustration or even rage. Consider a child having a temper tantrum. If whining and loud demands do not bring the reinforcer, the child may progress to kicking and screaming. If a vending machine takes your coins but fails to deliver candy or soda, you might shake the machine or even kick it before giving up. When we don't get something we expect, it makes us angry.

The process of *spontaneous recovery*, which we discussed in relation to classical conditioning, also occurs in operant conditioning. A rat whose bar pressing has been extinguished may again press the bar a few times when it is returned to the Skinner box after a period of rest.

Generalization and Discrimination Skinner conducted many of his experiments with pigeons placed in a specially designed Skinner box. The box contained small illuminated disks that the pigeons could peck to receive bits of grain from a food tray. Skinner found that **generalization** occurs in operant conditioning, just as in classical conditioning. A pigeon reinforced for pecking at a yellow disk is likely to peck at another disk similar in color. The less similar a disk is to the original color, the lower the rate of pecking will be.

Discrimination in operant conditioning involves learning to distinguish between a stimulus that has been reinforced and other stimuli that may be very similar. Discrimination develops when the response to the original stimulus is reinforced but responses to similar stimuli are not reinforced. For example, to encourage discrimination, a researcher would reinforce the pigeon for pecking at the yellow disk but not for pecking at the orange or red disk. Pigeons have even been conditioned to discriminate between a cubist-style Picasso painting and a Monet with 90% accuracy. However, they weren't able to tell a Renoir from a Cezanne (“Psychologists' pigeons . . .,” 1995).

Certain cues come to be associated with reinforcement or punishment. For example, children are more likely to ask their parents for a treat when the parents are smiling than when they are frowning. A stimulus that signals whether a certain response or behavior is likely to be rewarded, ignored, or punished is called a **discriminative stimulus**. If a pigeon's peck at a lighted disk results in a reward but a peck at an



B. F. Skinner shapes a rat's bar-pressing behavior in a Skinner box.

■ **extinction**

In operant conditioning, the weakening and eventual disappearance of the conditioned response as a result of the withholding of reinforcement.

■ **generalization**

In operant conditioning, the tendency to make the learned response to a stimulus similar to that for which the response was originally reinforced.

■ **discriminative stimulus**

A stimulus that signals whether a certain response or behavior is likely to be rewarded, ignored, or punished.

unlighted disk does not, the pigeon will soon be pecking exclusively at the lighted disk. The presence or absence of the discriminative stimulus—in this case, the lighted disk—will control whether the pecking takes place.

Why do children sometimes misbehave with a grandparent but not with a parent, or make one teacher's life miserable yet be model students for another? The children may have learned that in the presence of some people (the discriminative stimuli), their misbehavior will almost certainly lead to punishment, but in the presence of certain other people, it may even be rewarded.

Reinforcement

What is the goal of both positive reinforcement and negative reinforcement, and how is that goal accomplished with each?

Positive and Negative Reinforcement How did you learn the correct sequence of behaviors involved in using an ATM machine? Simple—a single mistake in the sequence will prevent you from getting your money, so you learn to do it correctly. What about paying bills on time? Doesn't prompt payment allow you to avoid those steep late-payment penalties? In each case, your behavior is reinforced, but in a different way.

Reinforcement is a key concept in operant conditioning and may be defined as any event that follows a response and strengthens or increases the probability of the response being repeated. There are two types of reinforcement, positive and negative. **Positive reinforcement**, which is roughly the same thing as a reward, refers to any pleasant or desirable consequence that follows a response and increases the probability that the response will be repeated. The money you get when you use the correct ATM procedure is a positive reinforcer.

Just as people engage in behaviors to get positive reinforcers, they also engage in behaviors to avoid or escape aversive, or unpleasant, conditions, such as late-payment penalties. With **negative reinforcement**, a person's or animal's behavior is reinforced by the termination or avoidance of an unpleasant condition. If you find that a response successfully ends an aversive condition, you are likely to repeat it. You will turn on the air conditioner to avoid the heat and will get out of bed to turn off a faucet and end the annoying "drip, drip, drip." Heroin addicts will do almost anything to obtain heroin to terminate their painful withdrawal symptoms. In these instances, negative reinforcement involves putting an end to the heat, the dripping faucet, and the withdrawal symptoms.

Primary and Secondary Reinforcers Are all reinforcers created equal? Not necessarily. A **primary reinforcer** is one that fulfills a basic physical need for survival and does not depend on learning. Food, water, sleep, and termination of pain are examples of primary reinforcers. And sex is a powerful reinforcer that fulfills a basic physical need for survival of the species. Fortunately, learning does not depend solely on primary reinforcers. If that were the case, people would need to be hungry, thirsty, or sex starved before they would respond at all. Much observed human behavior occurs in response to secondary reinforcers. A **secondary reinforcer** is acquired or learned through association with other reinforcers. Some secondary reinforcers (money, for example) can be exchanged at a later time for other reinforcers. Praise, good grades, awards, applause, attention, and signals of approval, such as a smile or a kind word, are all examples of secondary reinforcers.

■ reinforcement

Any event that follows a response and strengthens or increases the probability that the response will be repeated.



For many students, studying with classmates reduces the nervousness they feel about an upcoming exam. They respond to their test anxiety by joining a study group and studying more. Discussing the exam with other students helps alleviate the anxiety, as well. Thus, for these students, test anxiety is an important source of negative reinforcement.

Schedules of Reinforcement

Think about the difference between an ATM machine and a slot machine. Under the right conditions, you can get money from either of them. But the ATM machine gives you a reinforcer every time you use the right procedure, while the slot machine does so only intermittently. How is your behavior affected in each case?

Initially, Skinner conditioned rats by reinforcing each bar-pressing response with a food pellet. Reinforcing every correct response, known as **continuous reinforcement**, is the kind of reinforcement provided by an ATM machine, and it is the most effective way to condition a new response. However, after a response has been conditioned, partial or intermittent reinforcement is often more effective in maintaining or increasing the rate of response. How many people punch buttons on ATM machines just for fun? And how long will you keep on trying to get money from an ATM machine that hasn't responded to a couple of attempts in which you know you did everything right? Yet people will spend hours playing slot machines without being rewarded. **Partial reinforcement** (the slot machine type) is operating when some but not all responses are reinforced. In real life, reinforcement is almost never continuous; partial reinforcement is the rule.

Partial reinforcement may be administered according to any of several types of **schedules of reinforcement**. Different schedules produce distinct rates and patterns of responses, as well as varying degrees of resistance to extinction when reinforcement is discontinued. The effects of reinforcement schedules can vary somewhat with humans, depending on any instructions given to participants that could change their expectations (Lattal & Neef, 1996).

The two basic types of schedules are ratio and interval schedules. Ratio schedules require that a certain number of responses be made before one of the responses is reinforced. With interval schedules, a given amount of time must pass before a reinforcer is administered. These types of schedules are further subdivided into fixed and variable categories. (See Figure 5.6, on page 182.)

The Fixed-Ratio Schedule On a **fixed-ratio schedule**, a reinforcer is given after a fixed number of correct, nonreinforced responses. If the fixed ratio is set at 30 responses (FR-30), a reinforcer is given after 30 correct responses. When wages are paid to factory workers according to the number of units produced and to migrant farm workers for each bushel of fruit they pick, those payments are following a fixed-ratio schedule.

The fixed-ratio schedule is a very effective way to maintain a high response rate, because the number of reinforcers received depends directly on the response rate. The faster people or animals respond, the more reinforcers they earn and the sooner they earn them. When large ratios are used, people and animals tend to pause after each reinforcement but then return to the high rate of responding.

The Variable-Ratio Schedule The pauses after reinforcement that occur with a high fixed-ratio schedule normally do not occur with a variable-ratio schedule. On a **variable-ratio schedule**, a reinforcer is given after a varying number of nonreinforced responses, based on an average ratio. With a variable ratio of 30 responses (VR-30), people might be reinforced one time after 10 responses, another after 50, another after 30 responses, and so on. It would not be possible to predict exactly which responses will be reinforced, but reinforcement would occur 1 in 30 times, on average.

Variable-ratio schedules result in higher, more stable rates of responding than do fixed-ratio schedules. Skinner (1953) reported that, on this type of schedule, "a pigeon may respond as rapidly as five times per second and maintain this rate for many hours" (p. 104). The best example of the power of the variable-ratio schedule is found in the gambling casino. Slot machines, roulette wheels, and most other games of chance pay

What are the four types of schedules of reinforcement, and which type is most effective?

■ **positive reinforcement**

Any pleasant or desirable consequence that follows a response and increases the probability that the response will be repeated.

■ **negative reinforcement**

The termination of an unpleasant condition after a response, which increases the probability that the response will be repeated.

■ **primary reinforcer**

A reinforcer that fulfills a basic physical need for survival and does not depend on learning.

■ **secondary reinforcer**

A reinforcer that is acquired or learned through association with other reinforcers.

■ **continuous reinforcement**

Reinforcement that is administered after every desired or correct response; the most effective method of conditioning a new response.

■ **partial reinforcement**

A pattern of reinforcement in which some but not all correct responses are reinforced.

■ **schedule of reinforcement**

A systematic process for administering partial reinforcement that produces a distinct rate and pattern of responses and degree of resistance to extinction.

■ **fixed-ratio schedule**

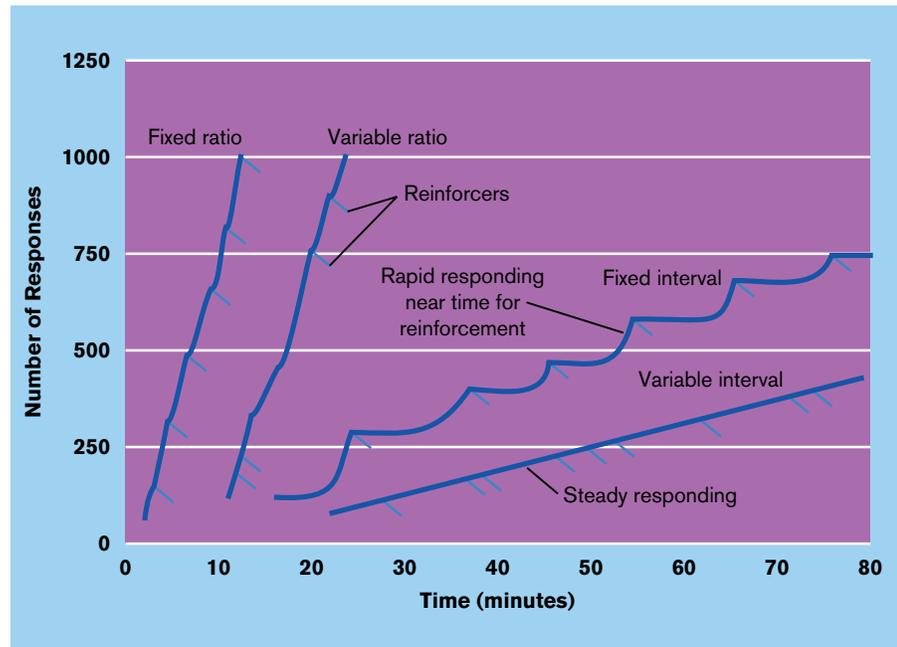
A schedule in which a reinforcer is given after a fixed number of correct, nonreinforced responses.

■ **variable-ratio schedule**

A schedule in which a reinforcer is given after a varying number of nonreinforced responses, based on an average ratio.

FIGURE 5.6 Four Types of Reinforcement Schedules

Skinner's research revealed distinctive response patterns for four partial reinforcement schedules (the reinforcers are indicated by the diagonal marks). The ratio schedules, based on the number of responses, yielded a higher response rate than the interval schedules, which are based on the amount of time elapsed between reinforcers.



on this type of schedule. In general, the variable-ratio schedule produces the highest response rate and the most resistance to extinction.

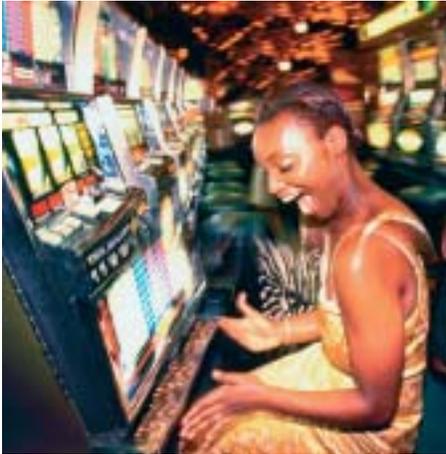
The Fixed-Interval Schedule On a **fixed-interval schedule**, a specific period of time must pass before a response is reinforced. For example, on a 60-second fixed-interval schedule (FI-60), a reinforcer is given for the first correct response that occurs 60 seconds after the last reinforced response. People who are on salary, rather than paid an hourly rate, are reinforced on the fixed-interval schedule.

Unlike ratio schedules, reinforcement on interval schedules does not depend on the number of responses made, only on the one correct response made after the time interval has passed. Characteristic of the fixed-interval schedule is a pause or a sharp decline in responding immediately after each reinforcement and a rapid acceleration in responding just before the next reinforcer is due.

The Variable-Interval Schedule Variable-interval schedules eliminate the pause after reinforcement typical of the fixed-interval schedule. On a **variable-interval schedule**, a reinforcer is given after the first correct response following a varying time of nonreinforced responses, based on an average time. Rather than being given every 60 seconds, for example, a reinforcer might be given after a 30-second interval, with others following after 90-, 45-, and 75-second intervals. But the average time elapsing between reinforcers would be 60 seconds (VI-60). This schedule maintains remark-

■ **fixed-interval schedule**
A schedule in which a reinforcer is given following the first correct response after a specific period of time has elapsed.

■ **variable-interval schedule**
A schedule in which a reinforcer is given after the first correct response that follows a varying time of nonreinforcement, based on an average time.



Two examples of variable-ratio schedules of reinforcement: Gamblers can't predict when the payoff (reinforcement) will come, so they are highly motivated to keep playing. Likewise, many computer users find themselves in the predicament of knowing they should stop playing solitaire and get to work, but they just can't seem to tear themselves away from the game. Why? The power of variable-ratio reinforcement motivates them to stick with the game until the next win, and the next, and the next



ably stable and uniform rates of responding, but the response rate is typically lower than that for ratio schedules, because reinforcement is not tied directly to the number of responses made. Random drug testing in the workplace is an excellent example of application of the variable-interval schedule that appears to be quite effective.

Review and Reflect 5.1 (on page 184) summarizes the characteristics of the four schedules of reinforcement.

The Effect of Continuous and Partial Reinforcement on Extinction One way to understand extinction in operant conditioning is to consider how consistently a response is followed by reinforcement. On a continuous schedule, a reinforcer is expected without fail after each correct response. When a reinforcer is withheld, it is noticed immediately. But on a partial-reinforcement schedule, a reinforcer is not expected after every response. Thus, no immediate difference is apparent between the partial-reinforcement schedule and the onset of extinction.

When you put money in a vending machine and pull the lever but no candy or soda appears, you know immediately that something is wrong with the machine. But if you were playing a broken slot machine, you could have many nonreinforced responses before you would suspect the machine of malfunctioning.

Partial reinforcement results in greater resistance to extinction than does continuous reinforcement (Lerman et al., 1996). This result is known as the **partial-reinforcement effect**. There is an inverse relationship between the percentage of responses that have been reinforced and resistance to extinction. That is, the lower the percentage of responses that are reinforced, the longer extinction will take when reinforcement is withheld. The strongest resistance to extinction ever observed occurred in one experiment in which pigeons were conditioned to peck at a disk. Holland and Skinner (1961) report that “after the response had been maintained on a fixed ratio of 900 and reinforcement was then discontinued, the pigeon emitted 73,000 responses during the first 4½ hours of extinction” (p. 124).

■ **partial-reinforcement effect**

The greater resistance to extinction that occurs when a portion, rather than all, of the correct responses are reinforced.

Reinforcement Schedules Compared

SCHEDULE OF REINFORCEMENT	RESPONSE RATE	PATTERN OF RESPONSES	RESISTANCE TO
Fixed-ratio schedule	Very high	Steady response with low ratio. Brief pause after each reinforcement with very high ratio.	The higher the ratio, the more resistance to extinction.
Variable-ratio schedule	Highest response rate	Constant response pattern, no pauses.	Most resistance to extinction.
Fixed-interval schedule	Lowest response rate	Long pause after reinforcement, followed by gradual acceleration.	The longer the interval, the more resistance to extinction.
Variable-interval schedule	Moderate	Stable, uniform response.	More resistance to extinction than fixed-interval schedule with same average interval.

Want to be sure you've fully absorbed the material in this chapter? Visit www.ablongman.com/wood5e for access to free practice tests, flashcards, interactive activities, and links developed specifically to help you succeed in psychology.

Parents often wonder why their children continue to whine in order to get what they want, even though the parents usually do not give in to the whining. Unwittingly, parents are reinforcing whining on a variable-ratio schedule, which results in the most persistent behavior. This is why experts always caution parents to be consistent. If parents never reward whining, the behavior will stop; if they give in occasionally, it will persist and be extremely hard to extinguish.

Reward seeking is indeed a powerful motivating force for both humans and animals. There is little doubt that rewards are among the most important of the influences that shape behavior (Elliott et al., 2000). However, the results of more than 100 studies suggest that the overuse of tangible rewards may have certain long-term negative effects, such as undermining people's intrinsic motivation to regulate their own behavior (Deci et al., 1999).

Why don't consequences always cause changes in behavior?

Factors Influencing Operant Conditioning

What factors, other than reinforcement schedules, influence learning from consequences? We have seen that the schedule of reinforcement influences both response rate and resistance to extinction. Three other factors affect response rate, resistance to extinction, and how quickly a response is acquired:

1. *The magnitude of reinforcement.* In general, as the magnitude of reinforcement increases, acquisition of a response is faster, the rate of responding is higher, and resistance to extinction is greater (Clayton, 1964). For example, in studies examining the influence of cash incentives on drug addicts' ability to abstain from taking the drug, researchers have found that the greater the amount of the incentive, the more likely the addicts are to abstain over extended periods of time (Dallery et al., 2001; Katz et al., 2002).

2. *The immediacy of reinforcement.* In general, responses are conditioned more effectively when reinforcement is immediate. As a rule, the longer the delay before reinforcement, the more slowly a response is acquired (Church, 1989; Mazur, 1993). (See Figure 5.7.) In animals, little learning occurs when there is any delay at all in reinforcement, because even a short delay obscures the relationship between the behavior and the reinforcer. In humans, a reinforcer sometime in the future is usually no match for immediate reinforcement in controlling behavior. Overweight people have difficulty changing their eating habits partly because of the long delay between their behavior change and the rewarding consequences of weight loss.
3. *The level of motivation of the learner.* If you are highly motivated to learn to play tennis, you will practice more and learn faster than if you have no interest in the game. Skinner (1953) found that when food is the reinforcer, a hungry animal will learn faster than a full animal. To maximize motivation, he used rats that had been deprived of food for 24 hours and pigeons that were maintained at 75–80% of their normal body weight.

Comparing Classical and Operant Conditioning Are you having difficulty distinguishing between classical and operant conditioning? In fact, the processes of generalization, discrimination, extinction, and spontaneous recovery occur in both classical and operant conditioning. And both types of conditioning depend on associative learning. However, in classical conditioning, an association is formed between two stimuli—for example, a tone and food, a white rat and a loud noise, a product and a celebrity. In operant conditioning, the association is established between a response and its consequences—for example, bar pressing and food, studying hard and a high test grade. Furthermore, in classical conditioning, the focus is on what precedes the response. Pavlov focused on what led up to the salivation in his dogs, not on what happened after they salivated. In operant conditioning, the focus is on what follows the response. If a rat's bar pressing or your studying is followed by a reinforcer, that response is more likely to occur in the future. Generally, too, in classical conditioning, the subject is passive and responds to the environment rather than acting on it. In operant conditioning, the subject is active and operates on the environment. Children do something to get their parents' attention or their praise.

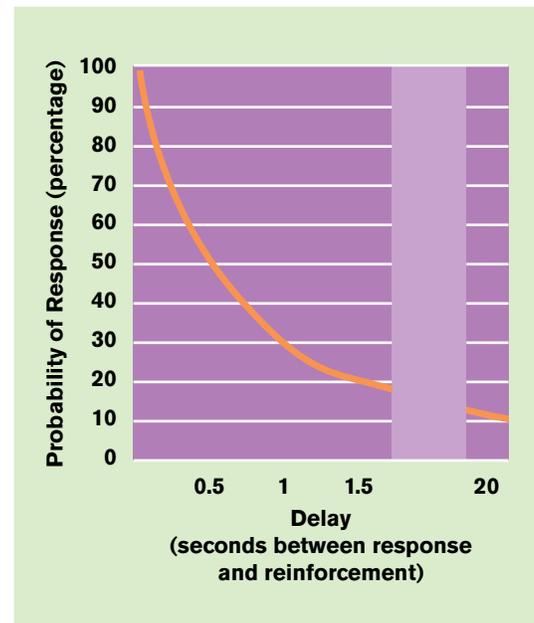
Review and Reflect 5.2 (on page 186) will help you understand and remember the major differences between classical and operant conditioning.

Punishment

You may be wondering about one of the most common types of consequences, punishment. **Punishment** is the opposite of reinforcement. Punishment usually lowers the probability of a response by following it with an aversive or unpleasant consequence. However, punishment can be accomplished by either adding an unpleasant stimulus or removing a pleasant stimulus. The added unpleasant stimulus might take the form of criticism, a scolding, a disapproving look, a fine, or a prison sentence. The removal of a pleasant stimulus

FIGURE 5.7 The Effect of a Delay in Reinforcement on the Conditioning of a Response

In general, responses are conditioned more effectively when reinforcement is immediate. The longer the delay in reinforcement, the lower the probability that a response will be acquired.



■ punishment

The removal of a pleasant stimulus or the application of an unpleasant stimulus, thereby lowering the probability of a response.

How does punishment differ from negative reinforcement?

Classical and Operant Conditioning Compared

CHARACTERISTICS	CLASSICAL CONDITIONING	OPERANT CONDITIONING
Type of association	Between two stimuli	Between a response and its consequence
State of subject	Passive	Active
Focus of attention	On what precedes response	On what follows response
Type of response typically involved	Involuntary or reflexive response	Voluntary response
Bodily response typically involved	Internal responses: emotional and glandular reactions	External responses: muscular and skeletal movement and verbal responses
Range of responses	Relatively simple	Simple to highly complex
Responses learned	Emotional reactions: fears, likes, dislikes	Goal-oriented responses

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might consist of withholding affection and attention, suspending a driver's license, or taking away a privilege such as watching television.

It is common to confuse punishment and negative reinforcement because both involve an unpleasant condition, but there is a big difference between the two. With punishment, an unpleasant condition may be added, but with negative reinforcement, an unpleasant condition is terminated or avoided. Moreover, the two have opposite effects: Unlike punishment, negative reinforcement increases the probability of a desired response by removing an unpleasant stimulus when the correct response is made. "Grounding" can be used as either punishment or negative reinforcement. If a teenager fails to clean her room after many requests to do so, her parents could ground her for the weekend—a punishment. An alternative approach would be to tell her she is grounded until the room is clean—negative reinforcement. Which approach is more likely to be effective?

The Disadvantages of Punishment Thus, if punishment can suppress behavior, why do so many people oppose its use? A number of potential problems are associated with the use of punishment:

1. According to Skinner, punishment does not extinguish an undesirable behavior; rather, it suppresses that behavior when the punishing agent is present. But the behavior is apt to continue when the threat of punishment is removed and in settings where punishment is unlikely. If punishment (imprisonment, fines, and so on) reliably extinguished unlawful behavior, there would be fewer repeat offenders in the criminal justice system.
2. Punishment indicates that a behavior is unacceptable but does not help people develop more appropriate behaviors. If punishment is used, it should be administered in conjunction with reinforcement or rewards for appropriate behavior.

The Effects of Reinforcement and Punishment

REINFORCEMENT (increases or strengthens a behavior)	PUNISHMENT (decreases or suppresses a behavior)
Adding a Positive (positive reinforcement) Presenting food, money, praise, attention, or other rewards.	Adding a Negative Delivering a pain-producing or otherwise aversive stimulus, such as a spanking or an electric shock.
Subtracting a Negative (negative reinforcement) Removing or terminating some pain-producing or otherwise aversive stimulus, such as an electric shock.	Subtracting a Positive Removing some pleasant stimulus, such as desserts or taking away a privilege, such as TV watching.

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- The person who is severely punished often becomes fearful and feels angry and hostile toward the punisher. These reactions may be accompanied by a desire to retaliate or to avoid or escape from the punisher and the punishing situation. Many runaway teenagers leave home to escape physical abuse. Punishment that involves a loss of privileges is more effective than physical punishment and engenders less fear and hostility (Walters & Grusec, 1977).
- Punishment frequently leads to aggression. Those who administer physical punishment may become models of aggressive behavior, by demonstrating aggression as a way of solving problems and discharging anger. Children of abusive, punishing parents are at greater risk than other children of becoming aggressive and abusive themselves (Widom, 1989).

If punishment can cause these problems, what can be done to discourage undesirable behavior?

Alternatives to Punishment Are there other ways to suppress behavior? Many psychologists believe that removing the rewarding consequences of undesirable behavior is the best way to extinguish a problem behavior. According to this view, parents should extinguish a child's temper tantrums not by punishment but by never giving in to the child's demands during a tantrum. A parent might best extinguish problem behavior that is performed merely to get attention by ignoring it and giving attention to more appropriate behavior. Sometimes, simply explaining why a certain behavior is not appropriate is all that is required to extinguish the behavior.

Using positive reinforcement such as praise will make good behavior more rewarding for children. This approach brings with it the attention that children want and need—attention that often comes only when they misbehave.

It is probably unrealistic to believe that punishment will ever become unnecessary. If a young child runs into the street, puts a finger near an electrical outlet, or reaches for a hot pan on the stove, a swift punishment may save the child from a potentially disastrous situation.

Review and Reflect 5.3 summarizes the differences between reinforcement and punishment.

Making Punishment More Effective When punishment is necessary (e.g., to stop destructive behavior), how can we be sure that it will be effective? Research has revealed several factors that influence the effectiveness of punishment: its timing, its intensity, and the consistency of its application (Parke, 1977).

1. Punishment is most effective when it is applied during the misbehavior or as soon afterward as possible. Interrupting the problem behavior is most effective because doing so abruptly halts its rewarding aspects. The longer the delay between the response and the punishment, the less effective the punishment is in suppressing the response (Camp et al., 1967). When there is a delay, most animals do not make the connection between the misbehavior and the punishment. For example, anyone who has tried to housebreak a puppy knows that it is necessary to catch the animal in the act of soiling the carpet for the punishment to be effective. With humans, however, if the punishment must be delayed, the punisher should remind the perpetrator of the incident and explain why the behavior was inappropriate.
2. Ideally, punishment should be of the minimum severity necessary to suppress the problem behavior. Animal studies reveal that the more intense the punishment, the greater the suppression of the undesirable behavior (Church, 1963). But the intensity of the punishment should match the seriousness of the misdeed. Unnecessarily severe punishment is likely to produce the negative side effects mentioned earlier. The purpose of punishment is not to vent anger but, rather, to modify behavior. Punishment meted out in anger is likely to be more intense than necessary to bring about the desired result. Yet, if the punishment is too mild, it will have no effect. Similarly, gradually increasing the intensity of the punishment is not effective because the perpetrator will gradually adapt, and the unwanted behavior will persist (Azrin & Holz, 1966). At a minimum, if a behavior is to be suppressed, the punishment must be more punishing than the misbehavior is rewarding. In human terms, a \$200 ticket is more likely to suppress the urge to speed than a \$2 ticket.
3. To be effective, punishment must be applied consistently. A parent cannot ignore misbehavior one day and punish the same act the next. And both parents should react to the same misbehavior in the same way. An undesired response will be suppressed more effectively when the probability of punishment is high. Would you be tempted to speed if you saw a police car in your rear-view mirror?



Culture shapes ideas about punishment. Because ideas about what is and is not humane punishment have changed in Western society, public humiliation is no longer considered to be an appropriate punishment, regardless of its potential for reducing crime.

Culture and Punishment Do you think stoning is an appropriate punishment for adultery? Probably not, unless you come from a culture in which such punishments are acceptable. Punishment is used in every culture to control and suppress people's behavior. It is administered when important values, rules, regulations, and laws are violated. But not all cultures share the same values or have the same laws regulating behavior. U.S. citizens traveling in other countries need to be aware of how different cultures view and administer punishment. For example, selling drugs is a serious crime just about everywhere. In the United States, it carries mandatory prison time; in some other countries, it is a death penalty offense.

Can you imagine being beaten with a cane as a legal punishment for vandalism? A widely publicized 1994 incident involving a young man named Michael Fay continues to serve as one of the best real-life examples of the sharp differences in concepts of crime and punishment between the United States and Singapore. Fay, an 18-year-old American living in Singapore, was arrested and charged with 53 counts of vandalism, including the spray painting of dozens of cars. He was fined approximately \$2,000, sentenced to 4 months in jail, and received four lashes with a rattan cane, an ago-

nizingly painful experience. In justifying their system of punishment, the officials in Singapore were quick to point out that their city, about the same size as Los Angeles, is virtually crime-free. Among Americans, sentiment about the caning was mixed. Some, including Fay's parents, viewed it as barbarous and cruel. But many Americans (51% in a CNN poll) expressed the view that caning might be an effective punishment under certain circumstances. What do you think?

Escape and Avoidance Learning

Remember the earlier example about paying bills on time to avoid late fees? Learning to perform a behavior because it prevents or terminates an aversive event is called *escape learning*, and it reflects the power of negative reinforcement. Running away from a punishing situation and taking aspirin to relieve a pounding headache are examples of escape behavior. In these situations, the aversive event has begun, and an attempt is being made to escape it.

Avoidance learning, in contrast, depends on two types of conditioning. Through classical conditioning, an event or condition comes to signal an aversive state. Drinking and driving may be associated with automobile accidents and death. Because of such associations, people may engage in behaviors to avoid the anticipated aversive consequences. Making it a practice to avoid riding in a car with a driver who has been drinking is sensible avoidance behavior.

Much avoidance learning is maladaptive, however, and occurs in response to phobias. Students who have had a bad experience speaking in front of a class may begin to fear any situation that involves speaking before a group. Such students may avoid taking courses that require class presentations or taking leadership roles that necessitate public speaking. Avoiding such situations prevents them from suffering the perceived dreaded consequences. But the avoidance behavior is negatively reinforced and thus strengthened through operant conditioning. Maladaptive avoidance behaviors are very difficult to extinguish, because people never give themselves a chance to learn that the dreaded consequences probably will not occur, or that they are greatly exaggerated.

There is an important exception to the ability of humans and other animals to learn to escape and avoid aversive situations: **Learned helplessness** is a passive resignation to aversive conditions, learned by repeated exposure to aversive events that are inescapable or unavoidable. The initial experiment on learned helplessness was conducted by Overmeier and Seligman (1967). Dogs in the experimental group were strapped into harnesses from which they could not escape and were exposed to electric shocks. Later, these same dogs were placed in a box with two compartments separated by a low barrier. The dogs then experienced a series of trials in which a warning signal was followed by an electric shock administered through the box's floor. However, the floor was electrified only on one side, and the dogs could have escaped the electric shocks simply by jumping the barrier. Surprisingly, the dogs did not do so. Dogs in the control group had not previously experienced the inescapable shock and behaved in an entirely different manner and quickly learned to jump the barrier when the warning signal sounded and thus escaped the shock. Seligman (1975) later reasoned that humans who have suffered painful experiences they could neither avoid nor escape may also experience learned helplessness. Then, they may simply give up and react to disappointment in life by becoming inactive, withdrawn, and depressed (Seligman, 1991).

Applications of Operant Conditioning

You have probably realized that operant conditioning is an important learning process that we experience almost every day. Operant conditioning can also be used intentionally by one person to change another person's or an animal's behavior.

When is avoidance learning desirable, and when is it maladaptive?

■ avoidance learning

Learning to avoid events or conditions associated with aversive consequences or phobias.

■ learned helplessness

A passive resignation to aversive conditions that is learned through repeated exposure to inescapable or unavoidable aversive events.

What are some applications of operant conditioning?



With biofeedback devices, people can see or hear evidence of internal physiological states and learn how to control them through various mental strategies.

Shaping the Behavior of Animals The principles of operant conditioning are used effectively to train animals not only to perform entertaining tricks but also to help physically challenged people lead more independent lives. Dogs and monkeys have been trained to help people who are paralyzed or confined to wheelchairs, and for years, seeing-eye dogs have been trained to assist the blind.

Through the use of shaping, animals at zoos, circuses, and marine parks have been conditioned to perform a wide range of amazing feats. After conditioning thousands of animals from over 38 different species to perform numerous feats for advertising and entertainment purposes, Breland and Breland (1961) concluded that biological predispositions in various species can affect how easily responses can be learned. When an animal's instinctual behavior runs counter to the behavior being conditioned, the animal will eventually

resume its instinctual behavior, a phenomenon known as *instinctual drift*. For example, picking up coins and depositing them in a bank is a task that runs counter to the natural tendencies of raccoons and pigs. In time, a raccoon will hold the coins and rub them together instead of dropping them in the bank, and the pigs will drop them on the ground and push them with their snouts.

Biofeedback Training your dog to roll over is one thing, but can you train yourself to control your body's responses to stress? For years, scientists believed that internal responses such as heart rate, brain-wave patterns, and blood flow were not subject to operant conditioning. It is now known that when people are given very precise feedback about these internal processes, they can learn, with practice, to exercise control over them. **Biofeedback** is a way of getting information about internal biological states. Biofeedback devices have sensors that monitor slight changes in these internal responses and then amplify and convert them into visual or auditory signals. Thus, people can see or hear evidence of internal physiological processes, and by trying out various strategies (thoughts, feelings, or images), they can learn which ones routinely increase, decrease, or maintain a particular level of activity.

Biofeedback has been used to regulate heart rate and to control migraine and tension headaches, gastrointestinal disorders, asthma, anxiety tension states, epilepsy, sexual dysfunctions, and neuromuscular disorders such as cerebral palsy, spinal cord injuries, and stroke (Kalish, 1981; L. Miller, 1989; N. E. Miller, 1985).

Behavior Modification Can operant conditioning help you get better grades? Perhaps, if you apply its principles to your study behavior. **Behavior modification** is a method of changing behavior through a systematic program based on the learning principles of classical conditioning, operant conditioning, or observational learning (which we will discuss soon). The majority of behavior modification programs use the principles of operant conditioning. *Try It 5.1* challenges you to come up with your own behavior modification plan.

Many institutions, such as schools, mental hospitals, homes for youthful offenders, and prisons, have used behavior modification programs with varying degrees of success. Such institutions are well suited for the use of these programs because they provide a restricted environment where the consequences of behavior can be more strictly controlled. Some prisons and mental hospitals use a **token economy**—a program that motivates socially desirable behavior by reinforcing it with tokens. The tokens (poker chips or coupons) may later be exchanged for desired items like candy or cigarettes and privileges such as weekend passes, free time, or participation in

■ **biofeedback**

The use of sensitive equipment to give people precise feedback about internal physiological processes so that they can learn, with practice, to exercise control over them.

■ **behavior modification**

A method of changing behavior through a systematic program based on the learning principles of classical conditioning, operant conditioning, or observational learning.

■ **token economy**

A program that motivates socially desirable behavior by reinforcing it with tokens that can be exchanged for desired items or privileges.

Try It 5.1

Applying Behavior Modification

Use conditioning to modify your own behavior.

1. *Identify the target behavior.* It must be both observable and measurable. You might choose, for example, to increase the amount of time you spend studying.
2. *Gather and record baseline data.* Keep a daily record of how much time you spend on the target behavior for about a week. Also note where the behavior takes



place and what cues (or temptations) in the environment precede any slacking off from the target behavior.

3. *Plan your behavior modification program.* Formulate a plan and set goals to either decrease or increase the target behavior.
4. *Choose your reinforcers.* Any activity you enjoy more can be used to reinforce any activity you enjoy less. For example, you could reward yourself with a movie after a specified period of studying.
5. *Set the reinforcement conditions and begin recording and reinforcing your progress.* Be careful not to set your reinforcement goals so high that it becomes nearly impossible to earn a reward. Keep in mind Skinner's concept of shaping through rewarding small steps toward the desired outcome. Be perfectly honest with yourself and claim a reward only when you meet the goals. Chart your progress as you work toward gaining more control over the target behavior.

desired activities. People in the program know in advance exactly what behaviors will be reinforced and how they will be reinforced. Token economies have been used effectively in mental hospitals to encourage patients to attend to grooming, to interact with other patients, and to carry out housekeeping tasks (Ayllon & Azrin, 1965, 1968). Although the positive behaviors generally stop when the tokens are discontinued, this does not mean that the programs are not worthwhile. After all, most people who are employed would probably quit their jobs if they were no longer paid.

Many classroom teachers and parents use *time out*—a behavior modification technique in which a child who is misbehaving is removed for a short time from sources of positive reinforcement. (Remember, according to operant conditioning, a behavior that is no longer reinforced will extinguish.)

Behavior modification is also used successfully in business and industry to increase profits and to modify employee behavior related to health, safety, and job performance. In order to keep their premiums low, some companies give annual rebates to employees who do not use up the deductibles in their health insurance plan. To reduce costs associated with automobile accidents and auto theft, insurance companies offer incentives in the form of reduced premiums for installing airbags and burglar alarm systems. To encourage employees to take company-approved college courses, some companies offer tuition reimbursement to employees who complete such courses with acceptable grades. Many companies promote sales by giving salespeople bonuses, trips, and other prizes for increasing sales. One of the most successful applications of behavior modification has been in the treatment of psychological problems ranging from phobias to addictive behaviors. In this context, behavior modification is called behavior therapy (discussed in Chapter 16).

Before moving on to cognitive learning, take a few moments to review the basic components of classical and operant conditioning listed in *Review and Reflect 5.2*.

Remember It 5.3

1. The process of reinforcing successive approximations of a behavior is known as _____ .
2. When reinforcers are withheld, _____ of a response occurs.
3. Taking aspirin to relieve a headache is an example of _____ reinforcement; studying to get a good grade on a test is an example of _____ reinforcement.
4. Glen and Megan are hired to rake leaves. Glen is paid \$1 for each bag of leaves he rakes; Megan is paid \$4 per hour. Glen is paid according to a _____ schedule; Megan is paid according to a _____ schedule.
5. Negative reinforcement _____ behavior, while punishment _____ behavior.
6. Victims of spousal abuse who have repeatedly failed to escape or avoid the abuse may eventually passively resign themselves to it, a condition known as _____ .
7. The use of sensitive electronic equipment to monitor physiological processes in order to bring them under conscious control is called _____ .
8. Applying learning principles to eliminate undesirable behavior and/or encourage desirable behavior is called _____ .

ANSWERS: 1. shaping; 2. extinction; 3. negative; 4. fixed-ratio; 5. strengthens, suppresses; 6. learned helplessness; 7. biofeedback; 8. behavior modification

Cognitive Learning

By now, you are probably convinced of the effectiveness of both classical and operant conditioning. But can either type of conditioning explain how you learned a complex mental function like reading? Behaviorists such as Skinner and Watson believed that any kind of learning could be explained without reference to internal mental processes. Today, however, a growing number of psychologists stress the role of mental processes. They choose to broaden the study of learning to include such **cognitive processes** as thinking, knowing, problem solving, remembering, and forming mental representations. According to cognitive theorists, understanding these processes is critically important to a more complete, more comprehensive view of learning. We will consider the work of three important researchers in the field of cognitive learning: Wolfgang Köhler, Edward Tolman, and Albert Bandura.

■ **cognitive processes**
(COG-nuh-tiv) Mental processes such as thinking, knowing, problem solving, remembering, and forming mental representations.

*What is insight,
and how does it
affect learning?*

Learning by Insight

Have you ever been worried about a problem, only to have a crystal clear solution suddenly pop into your mind? If so, you experienced an important kind of cognitive learning first described by Wolfgang Köhler (1887–1967). In his book *The Mentality of Apes* (1925), Köhler described experiments he conducted on chimpanzees confined in caged areas. In one experiment, Köhler hung a bunch of bananas inside the caged area but overhead, out of reach of the chimps; boxes and sticks were left around the cage. Köhler observed the chimps' unsuccessful attempts to reach the bananas by jumping up or swinging sticks at them. Eventually, the chimps solved the problem by piling the boxes on top of one another and climbing on the boxes until they could reach the bananas.

Köhler observed that the chimps sometimes appeared to give up in their attempts to get the bananas. However, after an interval, they returned with the solution to the

problem, as if it had come to them in a flash of **insight**. They seemed to have suddenly realized the relationship between the sticks or boxes and the bananas. Köhler insisted that insight, rather than trial-and-error learning, accounted for the chimps' successes, because they could easily repeat the solution and transfer this learning to similar problems. In human terms, a solution gained through insight is more easily learned, less likely to be forgotten, and more readily transferred to new problems than a solution learned through rote memorization (Rock & Palmer, 1990).

■ **insight**

The sudden realization of the relationship between elements in a problem situation, which makes the solution apparent.

Latent Learning and Cognitive Maps

Like Köhler, Edward Tolman (1886–1959) held views that differed from the prevailing ideas on learning. First, Tolman (1932) believed that learning could take place without reinforcement. Second, he differentiated between learning and performance. He maintained that **latent learning** could occur; that is, learning could occur without apparent reinforcement and not be demonstrated until the organism was motivated to do so. A classic experimental study by Tolman and Honzik (1930) supports this position.

Three groups of rats were placed in a maze daily for 17 days. The first group always received a food reward at the end of the maze. The second group never received a reward, and the third group did not receive a food reward until the 11th day. The first group showed a steady improvement in performance over the 17-day period. The second group showed slight, gradual improvement. The third group, after being rewarded on the 11th day, showed a marked improvement the next day and, from then on, outperformed the rats that had been rewarded daily (see Figure 5.8). The rapid improve-

What did Tolman discover about the necessity of reinforcement?

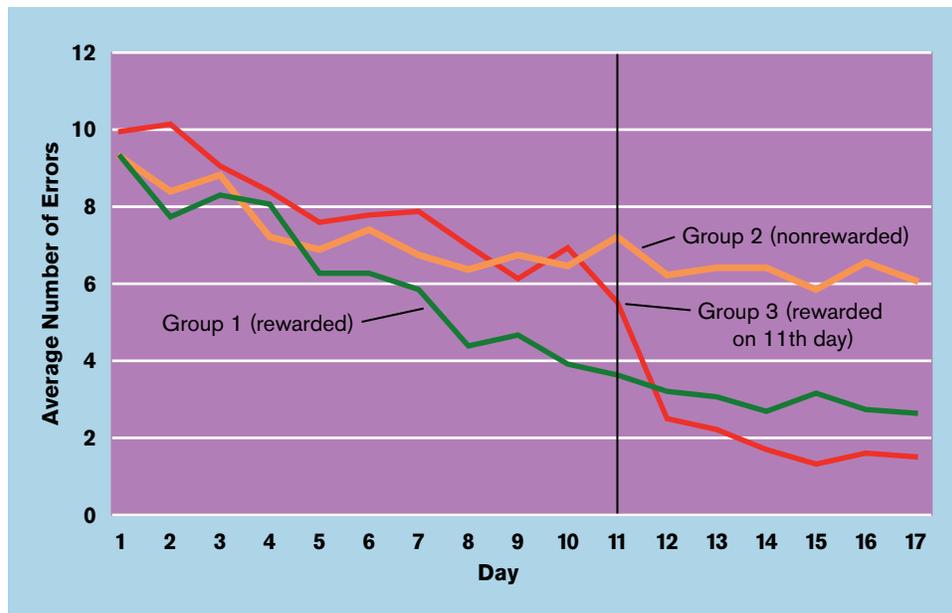
■ **latent learning**

Learning that occurs without apparent reinforcement and is not demonstrated until the organism is motivated to do so.

FIGURE 5.8 Latent Learning

Rats in Group 1 were rewarded every day for running the maze correctly, while rats in Group 2 were never rewarded. Group 3 rats were rewarded only on the 11th day and thereafter outperformed the rats in Group 1. The rats had “learned” the maze but were not motivated to perform until rewarded, demonstrating that latent learning had occurred.

Source: From Tolman & Honzik (1930).



ment of the third group indicated to Tolman that latent learning had occurred—that the rats had actually learned the maze during the first 11 days but were not motivated to display this learning until they were rewarded for it.

Skinner was still in graduate school in 1930, when Tolman provided this exception to a basic principle of operant conditioning—that reinforcement is required for learning new behavior. The rats in the learning group did learn something before reinforcement and without exhibiting any evidence of learning by overt, observable behavior. But what did they learn? Tolman concluded that the rats had learned to form a **cognitive map**, a mental representation or picture, of the maze but had not demonstrated their learning until they were reinforced. In later studies, Tolman showed how rats quickly learn to rearrange their established cognitive maps and readily find their way through increasingly complex mazes.

The very notion of explaining the rats' behavior with the concept of cognitive maps is counter to Skinner's most deeply held belief—that mental processes do not explain the causes of behavior. But the concepts of cognitive maps and latent learning have a far more important place in psychology today than was true in Tolman's lifetime. They provide a cognitive perspective on operant conditioning.

Observational Learning

Have you ever wondered why you slow down when you see another driver getting a speeding ticket? In all likelihood, no one has ever reinforced you for slowing down under these conditions, so why do you do it? Psychologist Albert Bandura (1986) contends that many behaviors or responses are acquired through observational learning, or as he calls it, *social-cognitive learning*. **Observational learning**, sometimes called **modeling**, results when

people observe the behavior of others and note the consequences of that behavior. Thus, you slow down when you see another driver getting a ticket because you assume their consequence will also be your consequence. The same process is involved when we see another person get a free soft drink by hitting the side of a vending machine. We assume that if we hit the machine, we will also get a free drink.

A person who demonstrates a behavior or whose behavior is imitated is called a **model**. Parents, movie stars, and sports personalities are often powerful models for children. The effectiveness of a model is related to his or her status, competence, and power. Other important factors are the age, sex, attractiveness, and ethnicity of the model. Whether learned behavior is actually performed depends largely on whether the observed models are rewarded or punished for their behavior and whether the observer expects to be rewarded for the behavior (Bandura, 1969, 1977a). Recent research has also shown that observational learning is improved when several sessions of observation (watching the behavior) precede attempts to perform the behavior and are then repeated in the early stages of practicing it (Weeks & Anderson, 2000).

But repetition alone isn't enough to cause an observer to learn from a model: An observer must be physically and cognitively capable of performing the behavior in order to learn it. In other words, no matter how much time you devote to watching Serena Williams play tennis or Tiger Woods play golf, you won't be able to acquire skills like theirs unless you possess physical talents that are equal to theirs. Likewise, it is doubtful that a kindergartener will learn geometry from watching her high-school-aged brother do his homework. Furthermore, the observer must pay attention to the model and store information about the model's behavior in memory. Ultimately, to exhibit a behavior learned through observation, the observer must be motivated to perform the behavior on her or his own.

A model does not have to be a person. For example, when you buy a piece of furniture labeled "assembly required," it usually comes with diagrams and instructions showing how to put it together. Typically, the instructions break down the large task of assembling the piece into a series of smaller steps. Similarly, Chapter 1 opens with



How do we
learn by observing
others?

■ cognitive map

A mental representation of a spatial arrangement such as a maze.

■ observational learning

Learning by observing the behavior of others and the consequences of that behavior; learning by imitation.

■ modeling

Another name for observational learning.

■ model

The individual who demonstrates a behavior or whose behavior is imitated.

an explanation of the SQ3R method that provides step-by-step instructions on how to incorporate the features of this textbook, such as the questions in the chapter outlines, into an organized study method. These instructions serve as a model, or plan, for you to follow in studying each chapter. As is true of learning from human models, you must believe that imitating this kind of verbal model will be beneficial to you. Moreover, you must remember the steps and be capable of applying them as you read each chapter. You will be more likely to keep using the SQ3R method if your experiences motivate you to do so. That is, once you use the model and find that it helps you learn the information in a chapter, you will be more likely to use it for another chapter.

One way people learn from observation is to acquire new responses, a kind of learning called the **modeling effect**. Do you remember learning how to do math problems in school? Most likely, when your teachers introduced a new kind of problems, they demonstrated how to solve them on a chalkboard or overhead projector. Your task was then to follow their procedures, step by step, until you were able to work the new problems independently. For you and your classmates, solving each new kind of problem was a new behavior acquired from a model.

Another kind of observational learning is particularly common in unusual situations. Picture yourself as a guest at an elaborate state dinner at the White House. Your table setting has more pieces of silverware than you have ever seen before. Which fork should be used for what? How should you proceed? You might decide to take your cue from the First Lady. In this case, you wouldn't be learning an entirely new behavior. Instead, you would be using a model to learn how to modify a known behavior (how to use a fork) to fit the needs of a unfamiliar situation. This kind of observational learning is known as the **elicitation effect**.

Sometimes, models influence us to exhibit behaviors that we have previously learned to suppress, a process called the **disinhibitory effect**. For example, we have all learned not to belch in public. However, if we are in a social setting in which others are belching and no one is discouraging them from doing so, we are likely to follow suit. And adolescents may lose whatever resistance they have to drinking, drug use, or sexual activity by seeing or hearing about peers or characters in movies or television shows engaging in these behaviors without experiencing any adverse consequences.

However, we may also suppress a behavior upon observing a model receive punishment for exhibiting it (the **inhibitory effect**). This is the kind of observational learning we are displaying when we slow down upon seeing another driver receiving a ticket. When schoolchildren see a classmate punished for talking out, the experience has a tendency to suppress that behavior in all of them. Thus, a person does not have to experience the unfortunate consequences of dangerous or socially unacceptable behaviors in order to avoid them.

Fears, too, can be acquired through observational learning. Gerull and Rapee (2002) found that toddlers whose mothers expressed fear at the sight of rubber snakes and spiders displayed significantly higher levels of fear of these objects when tested later than did control group children whose mothers did not express such fears. Conversely, children who see “a parent or peer behaving nonfearfully in a potentially fear-producing situation may be ‘immunized’” to feeling fear when confronting a similar frightening situation at a later time (Basic Behavioral Science Task Force, 1996, p. 139).

Review and Reflect 5.4 (on page 196) compares the three types of cognitive learning we've discussed.

Learning from Television and Other Media Close your eyes and picture a local TV news program. Is the anchor in your imaginary newscast a White or minority person? Research demonstrating the influence of models on behavior has raised concerns about what viewers, particularly children, learn from television. Racial stereotypes, for instance, are common in television programs. Moreover, minorities are shown in high-status roles far less often than Whites. Figure 5.9 (on page 196), for example, shows the percentages of various ethnic groups who serve as anchors for local news programs.

■ **modeling effect**

Learning a new behavior from a model through the acquisition of new responses.

■ **elicitation effect**

Exhibiting a behavior similar to that shown by a model in an unfamiliar situation.

■ **disinhibitory effect**

Displaying a previously suppressed behavior because a model does so without receiving punishment.

■ **inhibitory effect**

Suppressing a behavior because a model is punished for displaying the behavior.

Cognitive Learning

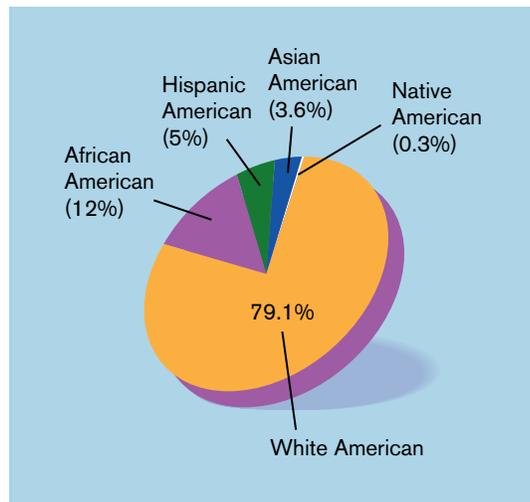
TYPE OF LEARNING	MAJOR CONTRIBUTORS	CLASSIC RESEARCH
Insight Sudden realization of how to solve a problem	Wolfgang Köhler	Observations of chimpanzees' attempts to retrieve bananas suspended from the tops of their cages
Latent learning Learning that is hidden until it is reinforced	Edward Tolman	Comparisons of rats that were rewarded for learning to run a maze with others that were allowed to explore it freely
Observational learning Learning from watching others	Albert Bandura	Comparisons of children who observed an adult model behaving aggressively with those who did not observe such an aggressive model

Want to be sure you've fully absorbed the material in this chapter? Visit www.ablongman.com/wood5e for access to free practice tests, flashcards, interactive activities, and links developed specifically to help you succeed in psychology.

FIGURE 5.9 Ethnicities of Local Television News Anchors

A survey of 818 television stations across the United States revealed that the vast majority of local television news anchors are White. Some psychologists believe that the lack of sufficient representation of minorities in such high-status roles may lead viewers to develop or maintain racial stereotypes.

Source: Papper & Gerhard (2002).



Thus, many psychologists believe that television watching can lead to the development and maintenance of racial stereotypes.

Albert Bandura suspected that aggression and violence on television programs, including cartoons, tend to increase aggressive behavior in children. His pioneering work has greatly influenced current thinking on these issues. In several classic experiments, Bandura demonstrated how children are influenced by exposure to aggressive models. One study involved three groups of preschoolers. Children in one group individually observed an adult model punching, kicking, and hitting a 5-foot, inflated plastic “Bobo Doll” with a mallet, while uttering aggressive phrases (Bandura et al., 1961, p. 576). Children in the second group observed a nonaggressive model who ignored the Bobo Doll and sat quietly assembling Tinker Toys. The children in the control group were placed in the same setting with no adult present. Later, each child was observed through a one-way mirror. Those children exposed to the aggressive model imitated much of the aggression and also engaged in significantly more nonimitative aggression than did children in either of the other groups. The group that observed the nonaggressive model showed less aggressive behavior than the control group.

A further study compared the degree of aggression in children following exposure to (1) an aggressive model in a live situation, (2) a filmed version of the same situation, or (3) a film depicting an aggressive cartoon character using the same aggressive behaviors in a fantasylike setting (Bandura et al., 1963). A control group was not exposed to any of



the three situations of aggression. The groups exposed to aggressive models used significantly more aggression than the control group. The researchers concluded that “of the three experimental conditions, exposure to humans on film portraying aggression was the most influential in eliciting and shaping aggressive behavior” (p. 7).

Bandura’s research sparked interest in studying the effects of violence and aggression portrayed in other entertainment media. For example, researchers have also shown in a variety of ways—including carefully controlled laboratory experiments with children, adolescents, and young adults—that violent video games increase aggressive behavior (Anderson & Bushman, 2001). Moreover, the effects of media violence are evident whether the violence is presented in music, music videos, or advertising or on the Internet (Villani, 2001). Such research has spawned a confusing array of rating systems that parents may refer to when choosing media for their children. However, researchers have found that labeling media as “violent” may enhance children’s desire to experience it, especially in boys over the age of 11 years (Bushman & Cantor, 2003).

But, you might argue, if televised violence is followed by appropriate consequences, such as an arrest, it may actually teach children not to engage in aggression. However, experimental research has demonstrated that children do not process information about consequences in the same ways as adults do (Krcmar & Cooke, 2001). Observing consequences for aggressive acts does seem to help preschoolers learn that violence is morally unacceptable. By contrast, school-aged children appear to judge the rightness or wrongness of an act of violence on the basis of provocation; that is, they believe that violence demonstrated in the context of retaliation is morally acceptable even if it is punished by an authority figure.

Remarkably, too, recently published longitudinal evidence shows that the effects of childhood exposure to violence persist well into the adult years. Psychologist L. Rowell Huesman and his colleagues (2003) found that individuals who had watched the greatest number of violent television programs in childhood were the most likely to have engaged in actual acts of violence as young adults. This study was the first to show that observations of media violence during childhood are linked to real acts of violence in adulthood.

But just as children imitate the aggressive behavior they observe on television, they also imitate the prosocial, or helping, behavior they see there. Programs like *Mister Rogers’ Neighborhood* and *Sesame Street* have been found to have a positive influence on children. And, hopefully, the findings of Huesman and his colleagues also apply to the positive effects of television.

Many avenues of learning are available to humans and other animals. Luckily, people’s capacity to learn seems practically unlimited. Certainly, advances in civilization could not have been achieved without the ability to learn.

In Bandura’s observational learning research, children learned to copy aggression by observing adult models act aggressively toward a Bobo doll.



Portrayals on television showing violence as an acceptable way to solve problems tend to encourage aggressive behavior in children.

Summary and Review

Classical Conditioning: The Original View p. 165

What kind of learning did Pavlov discover? p. 165

Pavlov's study of a conditioned reflex in dogs led him to discover a model of learning called classical conditioning.

How is classical conditioning accomplished? p. 166

In classical conditioning, a neutral stimulus (a tone in Pavlov's experiments) is presented shortly before an unconditioned stimulus (food in Pavlov's experiments), which naturally elicits, or brings forth, an unconditioned response (salivation for Pavlov's dogs). After repeated pairings, the conditioned stimulus alone (the tone) comes to elicit the conditioned response.

What kinds of changes in stimuli and learning conditions lead to changes in conditioned responses? p. 169

If the conditioned stimulus (tone) is presented repeatedly without the uncondi-

tioned stimulus (food), the conditioned response (salivation) becomes progressively weaker and eventually disappears, a process called extinction. Generalization occurs when an organism makes a conditioned response to a stimulus that is similar to the original conditioned stimulus. Discrimination is the ability to distinguish between similar stimuli, allowing the organism to make the conditioned response only to the original conditioned stimulus.

How did Watson demonstrate that fear could be classically conditioned? p. 171

Watson showed that fear could be classically conditioned by presenting a white rat to Little Albert along with a loud, frightening noise, thereby conditioning the child to fear the white rat. He also used the principles of classical conditioning to remove the fears of a boy named Peter.

KEY TERMS

learning, p. 165
classical conditioning, p. 165
stimulus, p. 165
reflex, p. 166
conditioned reflex, p. 167
unconditioned response (UR), p. 167
unconditioned stimulus (US), p. 167
conditioned stimulus (CS), p. 168
conditioned response (CR), p. 168
higher-order conditioning, p. 169
extinction, p. 169
spontaneous recovery, p. 169
generalization, p. 170
discrimination, p. 171

Classical Conditioning: The Contemporary View p. 172

According to Rescorla, what is the critical element in classical conditioning? p. 173

Rescorla found that the critical element in classical conditioning is whether the conditioned stimulus provides information that enables the organism to reliably predict the occurrence of the unconditioned stimulus.

What did Garcia and Koelling discover about classical conditioning? p. 173

Garcia and Koelling conducted a study in which rats formed an association between nausea and flavored water ingested several hours earlier. This represented an exception to the principle that the conditioned stimulus must be presented shortly before

the unconditioned stimulus. The finding that rats associated electric shock only with noise and light and nausea only with flavored water proved that animals are biologically predisposed to make certain associations and that associations cannot be readily conditioned between any two stimuli.

What types of everyday responses can be subject to classical conditioning? p. 174

Types of responses acquired through classical conditioning include positive and negative emotional responses (including likes, dislikes, fears, and phobias), responses to environmental cues associated with drug use, and conditioned immune system responses.

KEY TERM

taste aversion, p. 173

Why doesn't classical conditioning occur every time unconditioned and conditioned stimuli occur together? p. 176

Whenever unconditioned and conditioned stimuli occur close together in time, four factors determine whether classical conditioning occurs: (1) how reliably the conditioned stimulus predicts the uncondi-

tioned stimulus, (2) the number of pairings of the conditioned stimulus and unconditioned stimulus, (3) the intensity of the unconditioned stimulus, and (4) the temporal relationship between the conditioned stimulus and the unconditioned stimulus (the conditioned stimulus must occur first).

Operant Conditioning p. 177

What did Thorndike conclude about learning by watching cats try to escape from his puzzle box? p. 177

Thorndike concluded that most learning occurs through trial and error. He claimed that the consequences of a response determine whether the tendency to respond in the same way in the future will be strengthened or weakened (the law of effect).

What was Skinner's major contribution to psychology? p. 177

Skinner's major contribution to psychology was his extensive and significant research on operant conditioning.

What is the process by which responses are acquired through operant conditioning? p. 178

Operant conditioning is a method for manipulating the consequences of behavior in order to shape a new response or to increase or decrease the frequency of an existing response. In shaping, a researcher selectively reinforces small steps toward the desired response until that response is achieved. Extinction occurs when reinforcement is withheld.

What is the goal of both positive reinforcement and negative reinforcement, and how is that goal accomplished with each? p. 180

Both positive reinforcement and negative reinforcement are used to strengthen or increase the probability of a response. With positive reinforcement, the desired

response is followed by a reward; with negative reinforcement, it is followed by the termination of an aversive stimulus.

What are the four types of schedules of reinforcement, and which type is most effective? p. 181

The four types of schedules of reinforcement are the fixed-ratio, variable-ratio, fixed-interval, and variable-interval schedules. The variable-ratio schedule provides the highest response rate and the most resistance to extinction. The partial-reinforcement effect is the greater resistance to extinction that occurs when responses are maintained under partial reinforcement, rather than under continuous reinforcement.

Why don't consequences always cause changes in behavior? p. 184

In operant conditioning, response rate, resistance to extinction, and how quickly a response is acquired are influenced by the magnitude of reinforcement, the immediacy of reinforcement, and the motivation level of the learner. If the incentive is minimal, the reinforcement delayed, or the learner minimally motivated, consequences will not necessarily cause behavior changes.

How does punishment differ from negative reinforcement? p. 185

Punishment is used to decrease the frequency of a response; thus, an unpleasant stimulus may be added. Negative reinforcement is used to increase the frequency of a response, and so an unpleasant stimulus is

KEY TERMS

trial-and-error learning, p. 177
law of effect, p. 177
operant conditioning, p. 178
reinforcer, p. 178
shaping, p. 178
Skinner box, p. 178
successive approximations, p. 178
extinction, p. 179
generalization, p. 179
discriminative stimulus, p. 179
reinforcement, p. 180
positive reinforcement, p. 180
negative reinforcement, p. 180
primary reinforcer, p. 180
secondary reinforcer, p. 180
continuous reinforcement, p. 181
partial reinforcement, p. 181
schedule of reinforcement, p. 181
fixed-ratio schedule, p. 181
variable-ratio schedule, p. 181
fixed-interval schedule, p. 182
variable-interval schedule, p. 182
partial reinforcement effect, p. 183
punishment, p. 185
avoidance learning, p. 189
learned helplessness, p. 189
biofeedback, p. 190
behavior modification, p. 190
token economy, p. 190

terminated or avoided. Punishment generally suppresses rather than extinguishes behavior; it does not help people develop more appropriate behaviors. And it can cause fear, anger, hostility, and aggression in the punished person. Punishment is most effective when it is given immediately after undesirable behavior, when it is consistently applied, and when it is just intense enough to suppress the behavior.

When is avoidance learning desirable, and when is it maladaptive? p. 189

Avoidance learning involves acquisition of behaviors that remove aversive stimuli. Avoidance learning is desirable when it leads to a beneficial response, such as running away from a potentially deadly

snake or buckling a seat belt to stop the annoying sound of a buzzer. It is maladaptive when it occurs in response to fear. For example, fear of speaking to a group may lead you to skip class on the day your oral report is scheduled.

What are some applications of operant conditioning? p. 189

Applications of operant conditioning include training animals to provide entertainment or to help physically challenged people, using biofeedback to gain control over internal physiological processes, and using behavior modification techniques to eliminate undesirable behavior and/or encourage desirable behavior in individuals or groups.

Cognitive Learning p. 192

What is insight, and how does it affect learning? p. 192

Insight is the sudden realization of the relationship of the elements in a problem situation that makes the solution apparent; this solution is easily learned and transferred to new problems.

What did Tolman discover about the necessity of reinforcement? p. 193

Tolman demonstrated that rats could learn to run to the end of a maze just as quickly when allowed to explore it freely as when they were reinforced with food for getting to the end. His hypothesis was that the rats formed a cognitive map of the maze. He also maintained that latent learning occurs without apparent reinforcement,

but it is not demonstrated in the organism's performance until the organism is motivated to do so.

How do we learn by observing others? p. 194

Learning by observing the behavior of others (called models) and the consequences of that behavior is known as observational learning. We learn from models when we assume that the consequences they experience will happen to us if we perform their behaviors. Research has demonstrated that children can acquire aggressive behavior from watching televised acts of aggression. However, they can also learn prosocial behavior from television.

KEY TERMS

cognitive processes, p. 192
insight, p. 193
latent learning, p. 193
cognitive map, p. 194
observational learning, p. 194
modeling, p. 194
model, p. 194
modeling effect, p. 195
elicitation effect, p. 195
disinhibitory effect, p. 195
inhibitory effect, p. 195

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