MASTERING THE WORLD OF PSYCHOLOGY

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sample chapter

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Learning
If you have a dog, you may be able to relate to Michael and Lori’s story:

One day, their dog Jake decided he preferred to stay indoors at night, rather than be put into the backyard, as had been the rule since he was a puppy. He got his way by hiding in the house before Michael and Lori went to bed at night. Wanting to get as many hours of sleep as possible, Michael and Lori began a nightly ritual—going through the house, looking for Jake in closets and under the beds, and calling his name. But he never came when they called him at bedtime, and they were rarely able to find him.

Jake had associated their calling him at that time with being put outside before he was ready.

Then, when the spirit moved him (usually in the middle of the night), Jake would leap onto their bed, awakening Michael and Lori. After many sleepless nights, they were desperate for a solution to the problem.

Then, one day, when they were opening a can of soup, Jake raced through the house and slid to a stop in front of his bowl. He had learned to associate the sound of the can opener with food. So, Michael and Lori decided to conduct an experiment. Instead of calling Jake before bedtime, they began turning on the can opener when they were ready to put Jake out. The deception worked; the dog came running every time he heard the can opener. Michael and Lori felt a bit guilty about tricking Jake. Nevertheless, by applying simple learning principles, these dog owners were finally able to get a good night’s rest.
Learning may be defined 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 need further explanation. First, defining learning as a “relatively permanent change” excludes temporary changes that could result from illness, fatigue, or fluctuations in mood. Second, referring to a change that is “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.

Classical 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. He conducted classic experiments on the physiology of digestion, which won him a Nobel Prize in 1904—the first time this honor went to a Russian. In the course of his research, Pavlov designed a machine that could collect saliva from a dog’s mouth (see Figure 5.1). Quite by accident, Pavlov observed drops of saliva collecting in the machine’s containers when the dogs heard the footsteps of the laboratory assistants coming to feed them. How could an involuntary response such as salivation come to be associated with sounds that preceded feeding? Pavlov spent the rest of his life studying this question.

Classical conditioning is a form of learning in which an association is formed between one stimulus and another. A stimulus (plural, stimuli) is any event or object in the environment to which an organism responds.

➤ 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.
American flag are just names and symbols, but they tend to evoke strong emotional responses because of their associations. People’s lives are profoundly influenced by the associations learned through classical conditioning, sometimes referred to as respondent conditioning, or Pavlovian conditioning.

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, the salivation is an unlearned response, or unconditioned response (UR). Any stimulus, such as food, that without learning will automatically elicit, or bring forth, an unconditioned response is called an unconditioned stimulus (US).

<table>
<thead>
<tr>
<th>Unconditioned Stimulus (US)</th>
<th>Unconditioned Response (UR)</th>
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<tbody>
<tr>
<td>food</td>
<td>salivation</td>
</tr>
<tr>
<td>loud noise</td>
<td>startle</td>
</tr>
<tr>
<td>light in eye</td>
<td>contraction of pupil</td>
</tr>
<tr>
<td>puff of air in eye</td>
<td>eyeblink response</td>
</tr>
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Pavlov demonstrated that dogs could be conditioned to salivate to a variety of stimuli never before associated with food. 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 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 he called salivation after the tone the learned response, or conditioned response (CR). (See Figure 5.2.)

In a modern view of classical conditioning, the conditioned stimulus can be thought of as a signal that the unconditioned stimulus will follow (Schreurs, 1989). In Pavlov’s experiment, the tone became a signal that food would follow shortly. So, the signal (conditioned stimulus) gives advance warning, and the organism (animal or person) is prepared with the proper response (conditioned response), even before the unconditioned stimulus arrives (Gallistel & Gibbon, 2000).

Because the conditioned stimulus serves as a signal for 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. The ideal time between the presentations of the conditioned and the unconditioned stimuli is about 1/2 second, but this time 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).
Further, conditioned stimuli may be linked together to form a series of signals, a process called higher-order conditioning. For example, 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 the nurse prepares materials such as needles, syringes, and such. Next, some kind of constricting device is tied around your arm, and the nurse pats on the surface of your skin until a vein becomes visible. Each step in the sequence tells you that the unavoidable needle “stick” and the pain (largely the result of reflexive muscle tension) that follows 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, your muscles respond to your anxiety by contracting a bit more in anticipation of the stick, a conditioned response.

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 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 rate of responses during the processes of extinction and spontaneous recovery.
Pavlov also found that a tone similar to the original conditioned stimulus would produce the conditioned response (salivation), a phenomenon called \textit{generalization}. But the salivation decreased as the tone became less similar to the original conditioned stimulus, until the tone became so different that the dog would not salivate at all. Once the tone became sufficiently different, the dog exhibited \textit{discrimination}; that is, it had learned to respond only to tones within a certain range.

It is easy to see the value of generalization and discrimination in daily life. For instance, if you enjoyed being in school as a child, you probably feel more positive 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. Further, 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.

\textbf{John Watson, Little Albert, and Peter}

In 1919, John Watson (1878–1958) and his assistant, Rosalie Rayner, conducted a now-infamous study to prove that fear could be classically conditioned. In the laboratory, Rayner presented an 11-month-old infant, known as Little Albert, with a white rat. As Albert reached for the rat, Watson struck a 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 (see Figure 5.4). Moreover, when Albert returned to the laboratory 5 days later, the fear had generalized to a rabbit, a dog, a fur coat, Watson’s hair, and a Santa Claus mask. After 30 days Albert made his final visit to the laboratory. His fears were still 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 and his family moved away before they could be tried on him. Since Watson apparently knew that Albert would be leaving the area before these fear-removal techniques could be applied, he clearly showed a disregard for the child’s welfare. Fortunately, 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.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure53.png}
\caption{Extinction of a Classically Conditioned Response}

When a classically conditioned stimulus (the tone) was presented in a series of trials without the unconditioned stimulus (the 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. (Data from Pavlov, 1927/1960, p. 58.)
\end{figure}
Some of Watson’s ideas for removing fears were excellent and laid the groundwork for some 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 research participants. How is classical conditioning viewed today?

**Contemporary Views of Classical Conditioning**

Pavlov viewed classical conditioning as a mechanical process that resulted in a conditioned reflex more or less automatically. Beginning in the late 1960s, though, researchers began to discover exceptions to some of the general principles Pavlov identified.

**The Cognitive Perspective**

Psychologist Robert Rescorla (1967, 1968, 1988; Rescorla & Wagner, 1972) 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. 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 likewise received a shock 20 times while the tone was...
sounding, but this group also received 20 shocks that were not paired with the tone. 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.

**Biological Predispositions**

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 a **taste aversion**—the intense dislike and/or avoidance of a particular food that has been associated with nausea or discomfort. For example, experiencing nausea and vomiting after eating, say, a hotdog can be enough to condition a long-lasting taste aversion to hotdogs.

In a classic study of the role played by classical conditioning in the development of a taste aversion, Garcia and Koelling (1966) exposed rats to a three-way conditioned stimulus: a bright light, a clicking noise, and flavored water. 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. 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 between any two stimuli cannot be readily conditioned.

Other research on conditioned taste aversions has led to the solution of practical problems such as helping cancer patients. Bernstein and colleagues (Bernstein, 1985; Bernstein et al., 1982) 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 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 or unfavored food shortly before treatment. As a result, they are less likely to develop aversions to foods they normally eat and, in turn, more likely to maintain their body weight during treatment.

**Classical Conditioning in Everyday Life**

Many of our emotional responses—positive and negative—result from 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 dentist’s chair, the waiting room, or even the building where the dentist’s office is located. Neuroscientists have learned that this kind of fear conditioning is associated with both the amygdala and the hippocampus (Anagnostaras et al., 2000).

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). 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. This observation helps explain why the American soldiers who used heroin heavily in Vietnam had only a 7% addiction rate when they returned to the United States, where they no longer encountered many of the environmental cues associated with use of the drug (Basic Behavioral Science Task Force, 1996).

Businesspeople wine and dine customers, hoping that they and their product or service will elicit the same positive response as the pleasant setting and fine food. Advertisers seek to classically condition consumers when they show products along with 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, then 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). You might want to get an idea of just how the principles of classical conditioning are applied in TV advertising by doing Try It 5.1.

Research indicates that even the immune system is subject to classical conditioning (Ader, 1985; Ader & Cohen, 1982, 1993; Exton et al., 2000). In a classic study of this kind, 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, whether or not they had received 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. Checking further into the properties of the tasteless drug, Ader 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 successfully repeated the experiment with strict controls to rule out other explanations. How far-reaching the power of classical conditioning must be if a neutral stimulus such as sweetened water can produce effects similar to those of a powerful drug! And not only can classically conditioned stimuli suppress the immune system, they can be used to boost it as well (Exton et al., 2000; Markovic et al., 1993).

Recent research (Stanton, 2000) suggests that three basic components of learning are involved in classical conditioning: sensorimotor, affective (emotional), and cognitive components. Even the simplest of conditioned responses, such as the eyeblink reflex, involves all three of these learning components. The sensorimotor component of learning results in the eyeblink itself and is handled by neural circuits in the
brain’s cerebellum. The affective component of learning encodes the conditioned “fear” and depends on the neural circuitry of the amygdala. The cognitive component of learning consists of all higher-order learning and memory processes. It forms a representation of the entire conditioning episode, including the relationship between the conditioned stimulus and the unconditioned stimulus and the context (environment) in which conditioning occurs. The neural circuitry handling this cognitive component of learning is in the hippocampus (Stanton, 2000; Green & Woodruff-Pak, 2000).

Research indicates that the amygdala is involved in the conditioning of emotions such as fear. However, memories of such conditioning are stored in other areas of the brain, even though the neural circuits in the amygdala produce the intense emotions that occur with fear conditioning (Lehmann et al., 2000; Vazdarjanova, 2000). An intact hippocampus is also essential to the conditioning of emotions (Anagnostaras et al., 2000). 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).

Operant Conditioning

Thorndike and the Law of Effect

Based on his studies of trial-and-error learning in cats, dogs, chicks, and monkeys, American psychologist Edward Thorndike (1874–1949) 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 determines 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. It 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 just outside the box. The cat would first try to squeeze through the slats; when these attempts failed, it would scratch, bite, and claw inside the box. In time, the cat would accidentally trip the mechanism, which

What was Thorndike’s major contribution to psychology?

Thorndike’s law of learning, which states that the connection between a stimulus and a response will be strengthened if the response is followed by a satisfying consequence and weakened if the response is followed by discomfort.
operative conditioning
A type of learning in which the consequences of behavior are manipulated in order to increase or decrease that behavior in the future.

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

shaping
An operant conditioning technique that consists of gradually molding a desired behavior (response) by reinforcing responses that become progressively closer to it.

successive approximations
A series of gradual steps, each of which is more like the final desired response.

Skinner box
A soundproof chamber with a device for delivering food and either a bar for rats to press or a disk for pigeons to peck; used in operant conditioning experiments.

extinction
In operant conditioning, the weakening and often eventual disappearance of the conditioned response when reinforcement is withheld.

would open the door and release it. 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 formed the conceptual starting point for B. F. Skinner’s work in operant conditioning.

B. F. Skinner and Operant Conditioning

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). Following a failed attempt at becoming a writer after graduating 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 PhD in psychology in 1931. Like Watson, Skinner believed that the causes of behavior are in the environment and do not result from inner mental events such as thoughts, feelings, or perceptions. Rather, Skinner claimed that these inner mental events are themselves behaviors, and like any other behaviors, are shaped and determined by environmental forces. Although Skinner’s social theories generated controversy, little controversy exists about the significance of his research on operant conditioning.

In operant conditioning, the consequences of behavior are manipulated in order to increase or decrease the frequency of a response or to shape an entirely new response. Behavior that is reinforced—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 of change. 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, a technique Skinner used, 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, gradually guiding the responses closer and closer to the ultimate goal. The series of more closely matching responses are known as successive approximations.

Skinner designed a soundproof apparatus, commonly called a Skinner box, with which he conducted his experiments in operant conditioning. One version of the 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 (see Figure 5.5) and pigeons have learned to bowl and play Ping-Pong.
You have seen that responses followed by reinforcers tend to be repeated and that responses no longer followed by reinforcers will occur less and less frequently and eventually die out. 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. 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.

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. Using this technique, Skinner found that generalization occurs in operant 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 pecking at a lighted disk results in a reward but pecking at an unlighted disk does not, the pigeon will soon be pecking at the lighted disk but not at the unlighted one. The presence or absence of the discriminative stimulus—in this case, the lighting of a 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 behave like model students for another? The

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

discriminative stimulus
A stimulus that signals whether a certain response or behavior is likely to be followed by reward or punishment.

Figure 5.5
Shaping and Successive Approximations
If you were an animal trainer, what successive approximations would you use to train an elephant to stand on her hind legs, on command?
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 be overlooked, or even rewarded.

**Reinforcement**

Reinforcement is a key concept in operant conditioning and may be defined as any event that strengthens or increases the probability of the response that it follows. There are two types of reinforcement: positive and negative. Positive reinforcement, roughly the same thing as a reward, refers to any pleasant or desirable consequence that, if applied after a response, increases the probability of that response. Many employees will work hard for a raise or a promotion, salespeople will increase their efforts to get awards and bonuses, students will study to get good grades, and children will throw temper tantrums to get candy or ice cream. In these examples, the raises, promotions, awards, bonuses, good grades, candy, and ice cream are positive reinforcers.

Just as people engage in behaviors to get positive reinforcers, they also engage in behaviors to avoid or escape aversive, or unpleasant, stimuli. With negative reinforcement, a person’s or animal’s behavior is reinforced by the termination or avoidance of an aversive stimulus. If you find that a response successfully ends an aversive stimulus, you are likely to repeat it. You will turn off the air conditioner to terminate 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.

Responses that end discomfort and those that are followed by rewards are likely to be strengthened or repeated because both lead to a more desirable outcome. Some behaviors are influenced by a combination of positive and negative reinforcement. If you eat a plateful of rather disgusting leftovers to relieve intense hunger, you are eating solely to remove hunger, a negative reinforcer. But if your hunger is relieved by a delicious dinner at a fine restaurant, both positive and negative reinforcement have played a role: Your hunger has been removed, and the dinner has been a reward in itself.

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 by 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.

Initially, Skinner conditioned rats by reinforcing each bar-pressing response with a food pellet. Reinforcing every correct response, known as continuous reinforcement, is the most efficient way to condition a new response. However, after a response has been conditioned, partial or intermittent reinforcement is more effective in maintaining or increasing the rate of response. Partial reinforcement is operating when some but not all responses are reinforced.

Partial reinforcement results in a 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 $4\frac{1}{2}$ hours of extinction” (p. 124).

## Schedules of Reinforcement

Partial reinforcement may be administered according to different 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 (see Figure 5.6). 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.

### Fixed-ratio Schedule

On a fixed-ratio schedule, a reinforcer is given after a fixed number of nonreinforced responses. If the fixed ratio is set at 30 responses (FR-30), a reinforcer is given after 30 correct responses. Examples are payments to factory workers according to the number of units produced and to migrant farm workers for each bushel of fruit they pick. A 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 characteristic high rate of responding.

The pauses after reinforcement that occur with a high fixed-ratio schedule normally do not occur with the 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 first after 10 responses, then after 50, then again after 30 responses, and so on. They cannot predict exactly what number of responses will be reinforced, but, in this example, reinforcement is averaging 1 in 30. Variable-ratio schedules result in higher, more stable rates of responding than fixed-ratio schedules. Skinner (1953) reports that on this 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 on this type of schedule. In general, the variable-ratio schedule produces the highest response rate and the most resistance to extinction.

On a fixed-interval schedule, a specific time interval 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 working on salary 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.

Variable-interval schedules eliminate the pause after reinforcement that is typical with fixed-interval schedules. 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 successive reinforcers following after 90-, 45-, and 75-second intervals. But the average time elapsing between reinforcers would be 60 seconds (VI-60). This schedule maintains remarkably stable and uniform rates of responding, but the response rate is typically lower than that with 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 and appears to be quite effective. Review & Reflect 5.1 summarizes the characteristics of the four types of schedules of reinforcement.

Factors other than the schedule of reinforcement influence the operant conditioning process. For example, 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; Dallery et al., 2001; Katz et al., 2002). In addition, the longer the delay in reinforcement, the more slowly a response is acquired (Church, 1989; Mazur, 1993). The motivation of the learner contributes as well. Skinner 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.

Punishment

Punishment is the opposite of reinforcement. Punishment 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 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 stimulus, but there is a big difference between the two. Punishment may involve adding an aversive stimulus, but with negative reinforcement, an aversive stimulus 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 use negative reinforcement—to tell her she is grounded until the room is clean. Which approach is more likely to be effective?

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.

3. 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).

4. Punishment frequently leads to aggression. Those who administer physical punishment may become models of aggressive behavior—people who demonstrate 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 lead to such problems, what can be done to discourage undesirable behavior? Many psychologists believe that removing the rewarding conse-

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### Reinforcement Schedules Compared

<table>
<thead>
<tr>
<th>Schedule of Reinforcement</th>
<th>Response Rate</th>
<th>Pattern of Responses</th>
<th>Resistance to Extinction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed-ratio schedule</td>
<td>Very high</td>
<td>Steady response with low ratio. Brief pause after each reinforcement with very high ratio.</td>
<td>The higher the ratio, the more resistance to extinction.</td>
</tr>
<tr>
<td>Variable-ratio schedule</td>
<td>Highest response rate</td>
<td>Constant response pattern, no pauses.</td>
<td>Most resistance to extinction.</td>
</tr>
<tr>
<td>Fixed-interval schedule</td>
<td>Lowest response rate</td>
<td>Long pause after reinforcement, followed by gradual acceleration.</td>
<td>The longer the interval the more resistance to extinction.</td>
</tr>
<tr>
<td>Variable-interval schedule</td>
<td>Moderate</td>
<td>Stable, uniform response.</td>
<td>More resistance to extinction than fixed-interval schedule with same average interval.</td>
</tr>
</tbody>
</table>

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**What are some disadvantages of punishment?**

punishment

The removal of a pleasant stimulus or the application of an unpleasant stimulus, which tends to suppress a response.
quences of the behavior is the best way to extinguish an undesirable or 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 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 it. 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. Review & Reflect 5.2 summarizes the differences between reinforcement and punishment.

Making Punishment More Effective

It is probably unrealistic to believe that punishment can be dispensed with entirely. 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. 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. 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 minimal 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. Yet, if the initial punishment is too mild, it will have no effect. Similarly, gradually increasing the intensity of the punishment is not effective; the perpetrator will gradually adapt to it, 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.

   A person who wishes to apply punishment must understand that 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.

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 and Punishment

Punishment has been used throughout recorded history 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. A memorable incident—widely publicized when it occurred a decade ago and still relevant today—revealed sharp differences in concepts of crime and punishment between the United States and Singapore.
In 1994, Michael 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 agonizingly 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 free of crime—few murders, rapes, beatings, or robberies. Among Americans, sentiment about the caning was mixed. Some, including Michael’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.

**Escape and Avoidance Learning**

Learning to perform a behavior because it terminates an aversive event is called *escape learning*, and it reflects the power of negative reinforcement. Taking aspirin to relieve a pounding headache is an example of an escape behavior. *Avoidance learning*, in contrast, depends on two types of conditioning: classical and operant. Through classical conditioning, an event or condition comes to signal an aversive state. For example, a child may associate an increase in the volume of his parent’s voice with an impending punishment. Because of such associations, people may engage in behaviors to avoid the anticipated aversive consequences. So, the child stops an unacceptable behavior when his parent, in a louder-than-usual voice, tells him to do so, in order to avoid the punishment that is sure to follow.

Many avoidance behaviors occur 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 dreadful consequences. But the avoidance behavior is negatively reinforced and thus is strengthened through operant conditioning. Maladaptive avoidance behaviors are very difficult to extinguish, because people never give
learned helplessness
The learned response of resigning oneself passively to aversive conditions, rather than taking action to escape or avoid them; learned through repeated exposure to inescapable or unavoidable aversive events.

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

behavior modification
The systematic application of the learning principles of operant or classical conditioning or observational learning to individuals or groups in order to eliminate undesirable behavior and/or encourage desirable behavior.

token economy
A program that motivates and reinforces socially acceptable behaviors with tokens that can be exchanged for desired items or privileges.

Applications of Operant Conditioning

Operant conditioning has numerous applications. For example, the principles of operant conditioning are used effectively to train animals that 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, of course, for years, seeing-eye dogs have been trained to assist the blind.

Biofeedback, a procedure in which people learn to consciously control autonomic functions such as heart rate, is another important application of operant conditioning principles. Biofeedback devices have sensors that monitor slight changes in these physiological responses and then amplify and convert the changes into visual or auditory signals. Thus, people can see or hear evidence of internal 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 alleviate migraine and tension headaches, gastrointestinal disorders, asthma attacks, anxiety tension states, epileptic seizures, sexual dysfunctions, and neuromuscular disorders due to cerebral palsy, spinal-cord injuries, and stroke (Kalish, 1981; L. Miller, 1989; N. E. Miller, 1985).

Behavior modification is a method of changing behavior through a systematic program based on the principles of operant conditioning. Many institutions—schools, mental hospitals, homes for youthful offenders, and prisons—have used behavior modification programs with varying degrees of success. One type of behavior modification program is 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 goods such as candy or cigarettes and privileges such as weekend passes, free time, or participation in desired activities. 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). They have also been used in schools in an effort to encourage students to increase desirable behaviors such as reading books. 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). Try It! 5.2 challenges you to come up with your own behavior modification plan.

Before moving on to cognitive learning, take a few moments to review the basic components of classical and operant conditioning listed in Review & Reflect 5.3.
Cognitive Learning

According to cognitive theorists, **cognitive processes**—thinking, knowing, problem solving, remembering, and forming mental representations—are critically important to a more complete, more comprehensive view of learning than that provided by the conditioning theories.

Insight and Latent Learning

In his book *The Mentality of Apes* (1925), Wolfgang Köhler (1887–1967) describes an experiment in which he hung a bunch of bananas inside a cage containing chimps but overhead, out of reach of the apes; boxes and sticks were left in 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 one on top of the other until they could reach the bananas, as if it had come to them in a flash of **insight**. They seemed to have suddenly discovered 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. Humans often learn through insight, as you may have experienced if you have had a sudden “Aha! Now I understand!” moment when trying to solve some type of problem.

Edward Tolman (1886–1959) maintained that **latent learning**, like insight, could occur without reinforcement (Tolman, 1932). 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.

Try It / 5.2 Behavior Modification

You can develop a behavior modification plan to address one of your own behaviors you would like to change. Say, for example, you want to increase the time you spend studying. Follow these steps:

1. State the desired behavior change in measurable terms: “I would like to study at least an hour and a half a day” lends itself more easily to measurement than a goal such as “I would like to study more.”

2. Find out the current frequency of the behavior, known as the baseline in behavior modification terms. Make a chart showing how many minutes you study each day for a week and calculate the average number of minutes per day you are studying now.

3. Identify a reinforcer. You might decide to reinforce yourself for studying by “allowing” yourself to spend some time watching television after completing a certain amount of studying.

4. Decide on a reinforcement contingency—that is, how much studying will be required to earn TV-watching time. It’s best if both the time allotted to television and the amount of studying required to earn it are fixed. For example, you might choose to allow yourself 15 minutes of TV time for every 30 minutes of studying.

5. Implement your plan, and chart the number of minutes you spend studying each day for 2 weeks. This is the behavior modification phase of the plan.

6. After 2 weeks, stop reinforcing yourself for studying and keep a maintenance chart showing how many minutes per day you study when not using reinforcement. Did the study habits you developed during the behavior modification phase continue after reinforcement was stopped? If not, put yourself through another behavior modification phase, perhaps for a longer time or with a more powerful reinforcer.
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. The rapid improvement 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.

The rats in Tolman’s experiment 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 learned cognitive maps and find their way through increasingly complex mazes with ease.

**Observational Learning**

The earlier discussion of operant conditioning described how people and other animals learn by directly experiencing the consequences, positive or negative, of their behavior. But must people experience rewards and punishment firsthand in order to learn? Not according to Albert Bandura (1986), who contends that many behaviors or responses are acquired through observational learning, or, as he now 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. And observational learning is not restricted to humans. Monkeys, for example, learn specific fears by observing other monkeys (Cook et al., 1985).
The person who demonstrates the behavior or whose behavior is imitated is called the **model**. Parents, movie stars, and sports personalities can be powerful models. 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 model is rewarded or punished for the behavior and whether the observer expects to be rewarded for the behavior (Bandura, 1969, 1977a). 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 Jennifer Capriati play tennis or Tiger Woods play golf, you won’t be able to acquire skills like theirs unless you possess physical talents equal to theirs. Similarly, it is doubtful that a kindergarten will learn geometry from watching her 10th-grade brother do his homework.

Emotional responses are often acquired through observational learning. For instance, Gerull and Rappe (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 toddlers in a control group whose mothers had not expressed 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 confronted with a similar frightening situation later” (Basic Behavioral Science Task Force, 1996, p. 139).

Bandura suspected that aggressive behavior is particularly likely to be copied as a result of observational learning and that aggression and violence on TV programs, including cartoons, tend to increase aggression in children. One of his classic studies involved three groups of preschool children. Children in one group individually observed an adult model punching, kicking, and using a mallet to hit a 5-foot, inflated plastic “Bobo Doll,” while uttering aggressive phrases, as shown in Figure 5.7 (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. Children in the third group (the control group) were placed in the same setting with no adult present. Later, each child was observed through a one-way mirror. 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 two groups. Children who had observed the nonaggressive model showed less aggressive behavior than did children in the control group.

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**Figure 5.7**

Bandura’s Famous “Bobo Doll” Research

In Bandura’s observational learning research, children learned to copy aggression by observing adult models act aggressively toward a Bobo doll.
A further study compared the degree of aggression in children following exposure to (1) a live aggressive model, (2) a filmed version of the episode, and (3) a film depicting an aggressive cartoon character using the same aggressive behaviors in a fantasy-like setting (Bandura et al., 1963). A control group was not exposed to any of the three aggressive models. The groups exposed to the 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 provided the impetus for studying the effects of televised violence and aggression in both cartoons and regular programming. 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 across a wide range of categories: music, music videos, advertising, and the Internet (Villani, 2001).

Watching excessive violence gives people an exaggerated view of the pervasiveness of violence in society, while making them less sensitive to the victims of violence. Media violence also encourages aggressive behavior in children by portraying aggression as an acceptable and effective way to solve problems and by teaching new forms of aggression (Wood et al., 1991).

Some have argued that when televised violence is followed by appropriate consequences, such as arrest, children may learn not to engage in aggression. However, experimental research has demonstrated that chil-
Children do not process information about consequences in the same way adults do (Krcmar & Cooke, 2001). Children appear to judge the rightness or wrongness of an act of violence in terms of provocation; that is, they believe that violence as retaliation is morally acceptable, even if it is punished by an authority figure.

However, just as children imitate the aggressive behavior they observe on television, they also imitate the prosocial, or helping, behavior they observe. Programs such as *Mister Rogers’ Neighborhood* and *Sesame Street* have been found to have a positive influence on children.

### Classical Conditioning

➤ What was Pavlov’s major contribution to psychology?

Pavlov’s study of a conditioned reflex provided a model of learning called classical conditioning.

➤ How was classical conditioning accomplished in Pavlov’s experiments?

In Pavlov’s experiments, a neutral stimulus (a tone) was presented shortly before the unconditioned stimulus (food), which naturally elicited, or brought forth, an unconditioned response (salivation). After repeated pairings, the conditioned stimulus (the tone) alone elicited the conditioned response (salivation).

➤ What is higher-order conditioning?

Higher-order conditioning is a form of conditioning that results when a series of conditioned stimuli become associated.

➤ How do extinction, generalization, and discrimination develop in classical conditioning?

Extinction has occurred when the conditioned stimulus can be presented repeatedly without the unconditioned stimulus and the conditioned response no longer appears. Generalization has occurred when an organism makes a conditioned response to a stimulus similar to the original conditioned stimulus. Discrimination is the ability to distinguish between similar stimuli, so that the organism makes the conditioned response only to the original conditioned stimulus.

➤ How did Watson demonstrate that fear could be classically conditioned?

Watson showed that fear could be classically conditioned by presenting Little Albert with a white rat along with a loud, frightening noise, thereby conditioning the infant to fear the white rat.

### Contemporary Views of Classical Conditioning

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

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 two exceptions to traditional ideas about classical conditioning did Garcia and Koelling discover?

The fact that rats formed an association between nausea and the flavored water ingested several hours earlier was 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 associations cannot be readily conditioned between any two stimuli.

➤ What types of responses can be acquired through classical conditioning?

Types of responses that can be acquired through classical conditioning include taste aversions, positive and negative emotional responses (including likes, dislikes, fears, and phobias), drug cravings in former drug users, and conditioned immune responses.

### Operant Conditioning

➤ What was Thorndike’s major contribution to psychology?

Thorndike formulated the law of effect, which was the conceptual starting point for Skinner’s work on operant conditioning.

➤ What was Skinner’s major contribution to psychology?

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

➤ How are responses acquired through operant conditioning?

In operant conditioning, the consequences of a behavior are manipulated to shape a new response or to increase or decrease the frequency of an existing response.

➤ How is shaping used to condition a response?

In shaping, rather than waiting for the desired response to be emitted, a researcher selectively reinforces successive approximations toward the desired response until that response is achieved.

➤ How does extinction develop in operant conditioning?

KEY TERMS

- learning (p. 334)
- classical conditioning (p. 334)
- stimulus (p. 334)
- unconditioned response (p. 335)
- unconditioned stimulus (p. 335)
- conditioned stimulus (p. 335)
- conditioned response (p. 335)
- higher-order conditioning (p. 336)
- extinction (p. 336)
- spontaneous recovery (p. 336)
- generalization (p. 337)
- discrimination (p. 337)

- taste aversion (p. 339)
In operant conditioning, extinction occurs when reinforcement is withheld.

➤ What is the difference between positive reinforcement and negative reinforcement?

Both positive reinforcement and negative reinforcement strengthen or increase the probability of a response. With positive reinforcement, the response is followed by a pleasant consequence; with negative reinforcement, it is followed by the termination of an aversive condition.

➤ What is the partial-reinforcement effect?

The partial-reinforcement effect is the greater resistance to extinction that occurs when responses are maintained under partial reinforcement rather than under continuous reinforcement.

➤ What are the four types of schedules of reinforcement, and which type yields the highest response rate and the greatest resistance to extinction?

The four types of schedules of reinforcement are fixed-ratio, variable-ratio, fixed-interval, and variable-interval schedules. A variable-ratio schedule provides the highest response rate and the greatest resistance to extinction.

➤ How does punishment differ from negative reinforcement?

Punishment is used to decrease the frequency of a response; negative reinforcement is used to increase the frequency of a response.

➤ What are some disadvantages of punishment?

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.

➤ What three factors increase the effectiveness of punishment?

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 unwanted behavior.

➤ What are some applications of operant conditioning?

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

KEY TERMS

| law of effect (p. 341) |
| reinforcer (p. 342) |
| shaping (p. 342) |
| successive approximations (p. 342) |
| Skinner box (p. 342) |
| extinction (p. 343) |
| generalization (p. 343) |
| discriminative stimulus (p. 343) |
| reinforcement (p. 344) |
| positive reinforcement (p. 344) |
| negative reinforcement (p. 344) |
| primary reinforcer (p. 344) |
| secondary reinforcer (p. 344) |
| continuous reinforcement (p. 344) |
| partial reinforcement (p. 344) |
| schedule of reinforcement (p. 345) |
| fixed-ratio schedule (p. 345) |
| variable-ratio schedule (p. 345) |
| fixed-interval schedule (p. 346) |
| variable-interval schedule (p. 346) |
| punishment (p. 346) |
| learned helplessness (p. 350) |
| biofeedback (p. 350) |
| behavior modification (p. 350) |
| token economy (p. 350) |

Cognitive Learning

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

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 is latent learning?

Latent learning occurs without apparent reinforcement, but it is not demonstrated in the organism’s performance until the organism receives sufficient reinforcement to do so.

➤ What is observational learning?

Observational learning is learning by observing the behavior of others (called models) and the consequences of that behavior.

KEY TERMS

| cognitive processes (p. 351) |
| insight (p. 351) |
| latent learning (p. 351) |
| cognitive map (p. 352) |
| observational learning (p. 352) |
| modeling (p. 352) |
| model (p. 352) |
Study Guide for Chapter 5

Answers to all the Study Guide questions are provided at the end of the book.

Section One: Chapter Review

1. Classical conditioning was originally researched most extensively 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. For higher-order conditioning to occur, a neutral stimulus is typically paired repeatedly with an ________.
5. Five-year-old Jesse was bitten by his neighbor’s collie. He won’t go near that dog but seems to have no fear of other dogs, even other collies. Which learning process accounts for his behavior?
   a. generalization   c. extinction
   b. discrimination   d. spontaneous recovery
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. Which learning process did this demonstrate?
   a. generalization   c. extinction
   b. discrimination   d. spontaneous recovery
8. Garcia and Koelling’s research supports Pavlov’s contention that almost any neutral stimulus can serve as a conditioned stimulus. (true/false)
9. Which of the following responses 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?
   a. salivation response
   b. immune response
   c. taste aversion
   d. conditioned drug cravings
10. Counselors usually advise recovering drug addicts to avoid cues (people, places, and things) that are associated with their past drug use because the environmental cues may serve as conditioned stimuli for drug cravings. (true/false)
11. Classical conditioning can be used to suppress or to boost the immune system. (true/false)
12. Who researched trial-and-error learning using cats in puzzle boxes and formulated the law of effect?
   a. Watson   c. Skinner
   b. Thorndike   d. Pavlov
13. Operant conditioning was researched most extensively by ________.
14. Operant conditioning can be used effectively for all of the following except ________.
15. Which of the following processes occurs in operant conditioning when reinforcers are withheld?
16. Many people take aspirin to relieve painful headaches. Taking aspirin is a behavior that is likely to continue because of the effect of ________ reinforcement.
17. Which schedule of reinforcement yields the highest response rate and the greatest resistance to extinction?
18. Jennifer and Ashley are both employed raking leaves. Jennifer is paid $1 for each bag of leaves she rakes; Ashley is paid $4 per hour. Jennifer is paid according to the ________ schedule; Ashley is paid according to the ________ schedule.
19. Danielle’s parents have noticed that she has been making her bed every day, and they would like this to continue. Because they understand the partial-reinforcement effect, they will want to reward her every time she makes the bed. (true/false)
21. Recall what you have learned about classical and operant conditioning. Which of the following is descriptive of operant conditioning?
   a. An association is formed between a response and its consequence.
   b. The responses acquired are usually emotional reactions.
   c. The subject is usually passive.
   d. The response acquired is usually an involuntary or reflexive response.

22. Punishment is roughly the same as negative reinforcement. (true/false)

23. Punishment usually does not extinguish undesirable behavior. (true/false)

24. Depending on the circumstances, avoidance learning can be either adaptive or maladaptive. (true/false)

25. 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 ________ ________.

26. Using sensitive electronic equipment to monitor physiological processes in order to bring them under conscious control is called ________ ________.

27. Applying learning principles to eliminate undesirable behavior and/or encourage desirable behavior is called ________ ________.

28. The sudden realization of the relationship between the elements in a problem situation that results in the solution to the problem is called (latent learning, insight).

29. Learning that is not demonstrated until one is reinforced to perform the behavior is called
   a. learning by insight.
   b. observational learning.
   c. classical conditioning.
   d. latent learning.

30. Hayley has been afraid of snakes for as long as she can remember, and her mother has the same paralyzing fear. Hayley most likely acquired her fear through
   a. learning by insight.
   b. observational learning.
   c. classical conditioning.
   d. latent learning.

31. You are most likely to learn a modeled behavior if you
   a. repeat the behavior many times after watching the model perform it.
   b. are physically capable of performing the behavior.
   c. have never seen the behavior before.
   d. are personally acquainted with the model.

32. Match the researcher with the subject(s) researched.
   (1) Edward Tolman  (2) Albert Bandura  (3) Wolfgang Köhler
   a. observational learning
   b. cognitive maps
   c. learning by insight
   d. latent learning

In the blank following each statement below, list the learning principle illustrated by the statement.

1. Ben continues to play a slot machine even though he never knows when it will pay off. ________
2. Alice watched a movie about tornadoes and is now afraid of bad storms. ________
3. Joey is crying and asking for a candy bar. His mother gives in because doing so will make him stop crying for now—but Joey will most likely behave this way again. ________
4. Jan got sick eating lasagna and now never eats food containing tomato sauce. ________
5. Helen washed the dinner dishes, and her mother allowed her to watch television for 30 extra minutes that evening. ________
6. Sarah’s parents are advised to stop paying attention to her crying when it is time for bed and instead ignore it. ________
7. Frank is paid for his factory job once every two weeks. ________
8. Marty is scolded for running into the road and never does it again. ________
9. Ellen watches her lab partner mix the chemicals and set up the experiment. She then repeats the same procedure and completes her assignment. ________
10. Through associations with such things as food and shelter, pieces of green paper with pictures of past U.S. presidents on them become very powerful reinforcers. ________
11. Although he studied the problem, Jack did not seem to be able to figure out the correct way to reconnect the pipes under the sink. He took a break before he became too frustrated. Later he returned and immediately saw how to do it. ________
1. Classical conditioning is based on the association between _________, and operant conditioning is based on the association between a _________ and its _________.

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

3. Ed feeds the horses on his ranch every day at the same time. He notices that the horses now run to their feed troughs and whinny as if they know dinner is on its way as soon as they hear his truck coming up the drive. In this example, the conditioned stimulus is _________.

4. In question 3, the unconditioned stimulus is _________.

5. The unconditioned response of Pavlov’s dogs was _________.

6. In Pavlov’s classic experiment, the bell was originally a(n) _________ stimulus.

7. To get coyotes to stop eating sheep, ranchers poison sheep carcasses in the hope that coyotes that eat the carcasses will get sick enough to avoid eating sheep from that point on. The ranchers hope that the coyotes will avoid all types and sizes of sheep—which is an example of _________ in classical conditioning.

8. The ranchers in question 7 also hope that the coyotes will be able to distinguish between sheep and other more appropriate sources of food. This is an example of _________ in classical conditioning.

9. Eduardo loved eating at a certain fast-food restaurant. After a while even the giant logo sign in front of the restaurant would make him hungry every time he saw it. The restaurant ran a TV ad showing a clown standing by the logo sign. Pretty soon, every time Eduardo saw a clown, he became hungry. Eduardo’s responses are examples of _________ conditioning.

10. If Watson had wanted to extinguish Little Albert’s conditioned fear of white furry things, he would have presented the _________ stimulus without presenting the _________ stimulus.

11. The law of _________, developed by _________, states that a response that is followed by a satisfying consequence will tend to be repeated, while a response followed by discomfort will tend to be weakened.

12. Since researchers cannot tell rats to press the bar in a Skinner box for food or have them read “The Skinner Box Owner’s Manual,” they must initiate the bar-pressing response by rewarding _________ _________, an approach known as shaping.

13. Reinforcement is any event that follows a response and increases the probability of the response. _________ reinforcement involves the removal of a stimulus and _________ reinforcement involves the presentation of a stimulus.

14. You’re driving on an interstate highway and suddenly notice that you’ve been going 80 miles per hour without realizing it. Immediately after you slow down, you see the flashing light of a state police car, and you know you’re about to be pulled over. In this case the flashing light is a _________ stimulus.

15. Food is considered a _________ reinforcer; money is considered a _________ reinforcer.

16. If you were going to train a rat to press a bar for food, you would probably use _________ reinforcement for the initial training period and a _________-reinforcement schedule to strengthen the learned bar-pressing behavior.

17. In his experiments, Skinner used animals that had been deprived of food for 24 hours because _________ influences the rate at which operant conditioning occurs.

18. Bandura’s research demonstrated that children may learn _________ behaviors from watching models perform them on television.

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Section Three: Fill In the Blank

1. Pavlov is associated with _________.
   a. classical conditioning.
   b. operant conditioning.
   c. cognitive conditioning.
   d. Watsonian conditioning.

2. This theorist believed that the causes of behavior are in the environment and that inner mental events are themselves shaped by environmental forces.
   a. Bandura
   b. Pavlov
   c. Skinner
   d. Tolman

3. Which of the following theorists developed the concepts of latent learning and cognitive mapping?
   a. Pavlov
   b. Köhler
   c. Tolman
   d. Skinner

4. This theorist researched observational learning and the effects of modeling on behavior.
   a. Köhler
   b. Thorndike
   c. Skinner
   d. Bandura
5. Which of the following theorists is associated with research on reinforcement theory?
   a. Pavlov  c. Tolman  
   b. Skinner  d. Bandura

6. The concept that is associated with cognitive learning is
   a. negative reinforcement.  
   b. positive reinforcement.  
   c. latent learning.  
   d. the discriminative stimulus.

7. Jim has been sober since he completed a treatment program for alcoholics. He was told to stay away from his old drinking places. The danger is that he may start drinking again as a result of the conditioned stimuli in those environments. If he did, it would be a practical example of _________ in classical conditioning.
   a. extinction  
   b. spontaneous recovery  
   c. stimulus generalization  
   d. observational response sets

8. The seductive nature of a slot machine in a gambling casino is based on its _________ schedule of reinforcement.
   a. continuous  c. variable-ratio  
   b. fixed-interval  d. variable-interval

9. For Little Albert, the conditioned stimulus was
   a. the white rat.  
   b. a loud noise.  
   c. Watson.  
   d. based on negative reinforcement.

10. Positive reinforcement increases behavior; negative reinforcement
    a. decreases behavior.  
    b. has no effect on behavior.  
    c. removes a behavior.  
    d. also increases behavior.

11. A good example of a fixed-interval schedule of reinforcement is
    a. factory piece work.  
    b. a child’s weekly allowance.  
    c. a slot machine.  
    d. turning on a light switch.

12. The nice thing about continuous reinforcement is that it creates a behavior that is very resistant to extinction. (true/false)

13. Drug tolerance and taste aversion are real-world examples of
    a. operant conditioning.  
    b. classical conditioning.  
    c. observational learning.  
    d. cognitive mapping.

14. In _________ learning, a person or animal learns a response that _________ a negative reinforcer.
    a. escape; prevents the occurrence of  
    b. escape; terminates  
    c. avoidance; terminates  
    d. avoidance; initiates

15. Ms. Doe, a new teacher, is having a difficult time with her misbehaving second graders. When the principal enters the room, the children behave like perfect angels. In this case, the principal may be thought of as an/a
    a. positive reinforcer.  
    b. unconditioned stimulus.  
    c. shaping reinforcer.  
    d. discriminative stimulus.

16. According to Tolman, _________ _________ is defined as learning that occurs without apparent reinforcement but is not demonstrated until the organism is sufficiently reinforced to do so.
    a. classical conditioning  c. latent learning  
    b. modeling behavior  d. cognitive mapping

17. Skinner asserted that classical conditioning is based on unconscious motivation, while operant conditioning is based on conscious control of emotions. (true/false)

Section Five: Critical Thinking

1. Outline the strengths and limitations of classical conditioning, operant conditioning, and observational learning in explaining how behaviors are acquired and maintained.

2. The use of behavior modification has been a source of controversy among psychologists and others. Prepare arguments supporting each of these positions:
   a. Behavior modification should be used in society to shape the behavior of others.
   b. Behavior modification should not be used in society to shape the behavior of others.

3. Think of a behavior of a friend, family member, or professor that you would like to change. Using what you know about classical conditioning, operant conditioning, and observational learning, formulate a detailed plan for changing the targeted behavior.