6 Learning


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CHAPTER OUTLINE

As you enter the Mexican restaurant, the host greets you with a smile. You return the smile and hold up two fingers. He escorts you and your friend to an open booth and offers you glasses of ice water along with chips and salsa.

Soon, your server sees you close your menus. This brings her over to your table to take your order—fajitas for two. As you dive into the chips and salsa, you finish your water. You make eye contact with your server and point to your empty glass. A minute later, she brings the pitcher and refills it for you.

Ten minutes later, your server approaches your table carrying a double order of fajitas fresh from the kitchen. The sizzle makes your mouth water immediately, well before you take a bite.

As ordinary as they may seem, your behaviors in this Mexican restaurant display the remarkable ability each of us has to learn from experience. Think about it: how did you know that entering the restaurant and gesturing for a table for two would get you a comfortable seat along with ice water, chips, and salsa? How did you know that pointing to your glass would deliver more water? And why did your mouth water when you heard the sizzle of fajitas?

The answer to all of these questions is *learning*. When psychologists use this term, we don't necessarily mean the kind of deliberate learning that happens in schools, through reading textbooks or attending lectures. (You certainly didn't learn what to do in a Mexican restaurant by reading a manual about Mexican restaurants.) We use *learning* to refer to the process by which the events of everyday life influence future behavior. This kind of learning can happen when we notice that certain things always happen around the same time, so we associate them with each other, like the sizzle of the fajitas and their delicious taste. Or it can happen when we notice that certain actions bring about certain consequences—like pointing at your glass brought about more water. These are behaviors you didn't know from birth (a baby at the next table wouldn't display any of them), but that you acquired over the course of your life.

Humans aren't the only species with the capacity to learn. In fact, all animals learn from their experiences. The same general rules that govern the way animals learn govern the way humans learn, too. This similarity enables psychologists to conduct research on animals, as well as humans, to better understand the learning process. That learning research forms the foundation of this chapter.

What Is Learning?

YOU WILL LEARN:

6.1 how psychologists define learning.

6.2 how learning fits into the nature–nurture debate.

6.3 that learning occurs universally across species.

Learning is the process by which life experience causes change in the behavior or thinking of an organism. You adjust your behavior accordingly as consequences happen to you, especially those that result from your own actions. Consider Jenny, a 9-year-old girl with two uncles. Uncle Joe always takes Jenny out for ice cream in his red sports car. Now, whenever Jenny sees a red sports car coming down her street, she gets excited. Her Uncle Carl doesn't take Jenny out for ice cream when he comes over, but Jenny has noticed something else—whenever she asks to play basketball with Uncle Carl, he's out in the driveway shooting hoops with her within a minute. Now she asks him to shoot hoops as soon as he arrives.

In both of these situations, Jenny has learned what goes with what. Through her own experience, she has learned to *associate* certain pairs of events. And Jenny remembers what she has learned about each uncle. What you've learned tends to endure unless new experiences come along to change it. Consider your own relatives, including those you might not see for months at a time. What are the chances that you'll completely forget what you've learned about them and react as if they are complete strangers the next time you see them?

Learning is the essence of the nurture side of the nature–nurture debate that surrounds all of human behavior. On the nature side of the argument is *maturation*, which causes some behaviors to take place because the animal's biological clock says it is time for them. For example, potty training works with most kids at age 2 or 3 (but not earlier) because younger children simply don't have the mental or physical capabilities to learn this behavior, no matter the efforts of their parents. Dating follows a similar pattern—the main reason it emerges in the teenage years (and not, say, around kindergarten) is puberty. Of course, maturation and learning (that is, nature and nurture) often work in tandem. For example, when the toddler starts potty training or when the teenager starts to date, positive experiences will accelerate the process and negative experiences will delay it.

All species learn. Even the California sea slug, a biologically small, simple animal found in the Pacific Ocean, shows the ability to learn to avoid electric shock by behaving in particular ways in response to particular conditions. Darren J. Bradley/Shutterstock

So far, all of the examples have featured people, but don't let that mislead you: learning isn't unique to humans. All species learn. Consider the California sea slug (*Aplysia californica*), which is found in the ocean off the west coast of the United States and Mexico. Researchers study this little animal—only about 6 to 8 inches long and weighing far less than a pound—because it learns through life experience, as larger, more complex animals (including humans) do. For example, when researchers poked one part of its body and then immediately delivered electric shock to another part, it soon learned to withdraw the second body part as soon as it sensed another poke in the first body part (Carew et al., 1983, 1981). In a separate study, researchers delivered the electric shock only if the sea slug allowed its gill to fall below a certain height. In these cases, the sea slug kept its gill raised high much longer than normal, which it apparently learned to do in order to avoid the shock (Hawkins et al., 2006).

As implied by the studies of the California sea slug, researchers who study learning make few distinctions between species. Some biological factors are unique to certain species (we will consider them later), but the processes by which one type of animal learns are basically the same as the processes by which any other type of animal learns. For this reason, a lot of learning studies use animals as participants—from pigeons to rats, from dogs to cats—with the assumption that the findings can be applied to the way humans learn (Ator, 1991; Delgado et al., 2006; Barad, 2005). Some of the earliest and most important learning research was stumbled upon by Ivan Pavlov in his work with dogs. Let's consider Pavlov's pioneering work next.

CHECK YOUR LEARNING:

6.1 How do psychologists define learning?

6.2 How does learning fit into the nature–nurture debate?

6.3 Is learning unique to humans?

Classical Conditioning

Ivan Pavlov, one of the most prominent figures in the history of psychology, was not a psychologist at all. He was a Russian medical researcher (a physiologist, to be specific) who in the late 1800s devoted his professional life to the study of the digestive system (Windholz, 1997; Babkin, 1949). Pavlov examined secretions made by various parts of the digestive tract, including saliva, which is produced in the mouth to start the digestive process. Pavlov was measuring the amount of saliva that dogs produced when food entered their mouths when he made an accidental discovery.

YOU WILL LEARN:

6.4 who Ivan Pavlov was and why his research with dogs was important.

6.5 what classical conditioning is and how it occurs in your life.

6.6 the components of classical conditioning.

6.7 how we generalize or discriminate what we learn.

6.8 how learned associations can be acquired and extinguished.

6.9 how multiple learned associations can be linked to produce higher-order conditioning.

6.10 how we learn vicariously through others' life experiences.

Pavlov's Accidental Discovery

Initially, everything in Pavlov's digestive research was going well. Pavlov had the dogs in their harnesses. His assistant would bring the food to the dogs, and they would measure how much the dogs' mouths watered with the help of specialized equipment.

But a problem arose. The dogs started salivating too soon. They weren't salivating *when* the food arrived, but *before* the food arrived. At first, this problem frustrated and perplexed Pavlov. The dogs had picked up on cues that the food was on the way—perhaps the sight of the assistant who brought the food or the sound of the door opening as the assistant entered the room—and were salivating in *anticipation* of the food (Mook, 2004). Pavlov realized that the dogs' expectant mouth-watering was a problem for his digestive research, but he also realized this "problem" was actually a fascinating phenomenon that happened to the dogs, to humans, and to other species as well. By the early 1900s, Pavlov decided to shift the direction of his research entirely to the study of what he called *conditioned reflexes*—a bold move for a researcher who had won the Nobel Prize for his studies of digestion (Fancher & Rutherford, 2012). These learning studies Pavlov conducted shaped the field of psychology.

In his research, Pavlov focused on **classical conditioning:** a form of learning in which animals or people make a connection between two stimuli that have occurred together such that one predicts the other. Essentially, Pavlov designed studies that intentionally created the kind of anticipatory salivation in dogs that originally happened by accident (Pavlov, 1927, 1928). His first step was to identify a **neutral simulus**: a stimulus that causes no response at all. He used sounds such as a bell for the neutral stimulus because its sound produced no salivation (or any other reaction) in the dog (**Figure 6.1**). Next, he identified food as the **unconditioned stimulus**: a stimulus

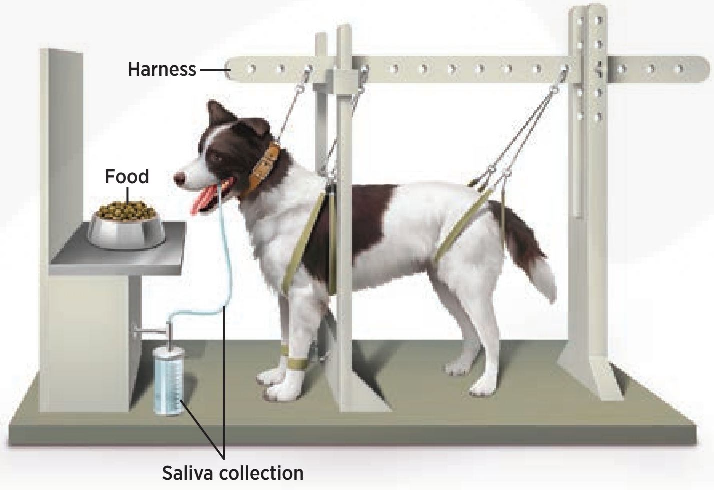


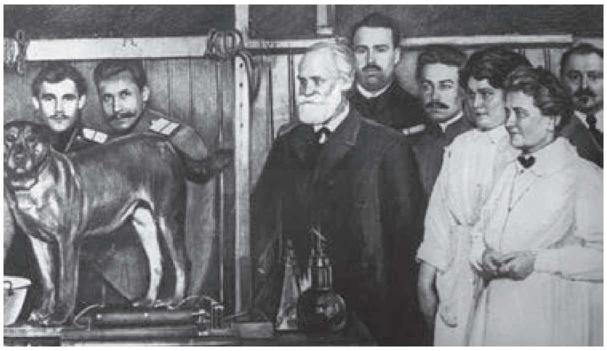
FIGURE 6.1 **Pavlov's Classical Conditioning** For his research on classical conditioning, Pavlov placed dogs in an apparatus that allowed him to measure their salivation. At first, dogs salivated only when food was placed in front of them, but after Pavlov repeatedly paired the food with the sound of a bell, dogs eventually salivated to the sound of the bell by itself.

learning
The process by which life experience causes change in the behavior or thinking of an organism.

classical conditioning
A form of learning in which animals or people make a connection between two stimuli that have occurred together, such that one predicts the other.

neutral stimulus
A stimulus that causes no response at all.

unconditioned stimulus
A stimulus that causes a response automatically, without any need for learning.



Ivan Pavlov and his colleagues were conducting research on the digestive system in the late 1800s in Russia when they shifted their focus to learning and more specifically classical conditioning. Sovfoto/UIG via Getty Images

that causes a response automatically, without any need for learning. Food certainly fits the bill, since a dog instinctively salivates to food as a natural biological reflex. That salivation in response to the food is the dog's **unconditioned response**: the automatic response to a stimulus that occurs naturally, without any need for learning.

Next, the conditioning happens. In other words, Pavlov paired the neutral stimulus and the unconditioned stimulus by ringing the bell, then immediately putting food in the dog's mouth (**Figure 6.2**). The dog eventually notices the repetition of this sequence—*bell–food, bell–food, bell–food*. Soon enough the dog salivates to the sound of the bell *even if there is no food*. By this process, the bell transforms from a neutral stimulus to a **conditioned stimulus**: a formerly neutral stimulus that now causes a response because of its link to an unconditioned stimulus. This salivation—specifically, salivation in response to the bell rather than the food—is called the **conditioned response**: the response to a conditioned stimulus acquired through learning.

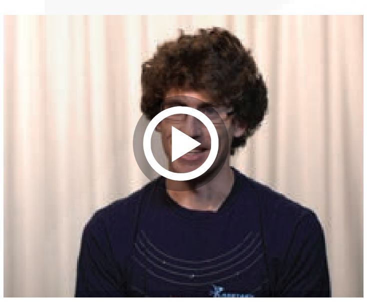
So Pavlov made dogs' mouths water in response to the sound of a bell that had absolutely no effect on them just hours before. This happened because the bell sounded before the food, which naturally caused the salivation before any conditioning took place. Once the dogs learned that the bell predicted food, they salivated to the bell just as automatically and involuntarily as they always had to food itself (Pavlov, 1927, 1928; Kehoe & Macrae, 1998).

That may happen to dogs in a lab study, but does it happen to people in the real world too?

Ever notice your mouth water when you hear the *pffst* of a soda can opening? It's the same phenomenon. Soda automatically makes your mouth water. It is an unlearned biological response to good-tasting liquids entering your mouth. In this case, soda is the unconditioned stimulus, and your salivation to soda is the unconditioned response.

MY TAKE VIDEO 6.1

Classical Conditioning



"Classical conditioning was involved when I was working in the Marine Corps as a dog handler..."

YOUTUBE: http://tiny.cc/mytake

LAUNCHPAD: launchpadworks.com

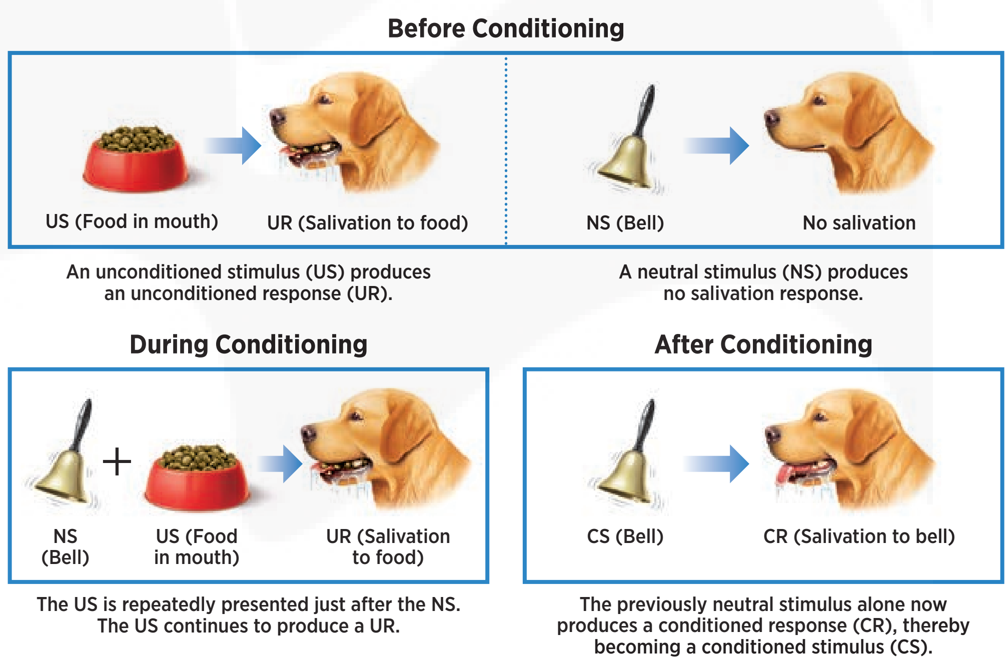


FIGURE 6.2 **Pavlov's Classical Conditioning Experiment** *Before* a dog undergoes any conditioning, it salivates to food. In other words, food is an unconditioned stimulus, and salivating to food is an unconditioned response. Before conditioning, the sound of a bell causes no response in the dog at all. *During* conditioning, the food and bell are presented at the same time over and over again (*bell–food*; *bell–food*; *bell,–food...*). *After* conditioning, because of what the dog has learned by the repeated pairing of the bell and the food, the dog salivates to the bell. The bell, which used to be a neutral stimulus, is now a conditioned stimulus. And salivating to the bell is now a conditioned response.

FROM RESEARCH TO REAL LIFE

Classical Conditioning in Advertising

If Pavlov's dogs had money, they might have spent it on bells. That's quite odd, given that dogs are usually indifferent to bells. But Pavlov did such a good job pairing bells with food, which the dogs inherently liked, that he transformed bells from irrelevant to exciting. It's as if some of the thrill dogs naturally feel toward food rubbed off on the bell.

Advertisers do the same thing to us every day. They don't call it classical conditioning, though. They call it branding. Just as Pavlov did, they pair their product (which is originally irrelevant to us) with something we inherently like or find exciting. With repetition, the product begins to take on the qualities of the well-liked, exciting person or thing with which it has been paired (Schachtman et al., 2011; Till & Priluck, 2000; De Houwer et al., 2001).

Let's consider Nike, with its iconic swoosh logo, as an example. This may be difficult to imagine, given how much Nike advertises, but there was a time early in your life when that swoosh meant absolutely nothing to you. It was just a random, meaningless shape, much as the bell was a random, meaningless sound to a dog entering Pavlov's lab for the first time. Over time, though, you saw the swoosh again and again. And Nike was very selective about who you saw it paired with: Michael Jordan, Pete Sampras, Michelle Wie, LeBron James, Roger Federer, Serena Williams, Carli Lloyd, Kevin Durant, Rory McIlroy, Maria Sharapova, Cristiano Ronaldo, and Russell Westbrook. In short, you saw the Nike swoosh paired with exciting and wildly successful athletes. In time, some of that excitement and success rubbed off on to the swoosh, so that the swoosh itself carried those qualities.

If Pavlov had worked for Nike, he would have explained it this way: the athlete is the unconditioned stimulus, and your positive reaction to the athlete is the unconditioned response. Nike knows that you already have that reaction built in. Nike's strategy is to pair its swoosh with the athlete, so the swoosh eventually becomes the conditioned response. Your positive response to the swoosh is the conditioned response—the advertising equivalent of a dog salivating to a bell.

Why does Nike pay millions of dollars to athletes like LeBron James and Maria Sharapova? It's simple: classical conditioning. Nike knows that if it pairs its swoosh with exciting, successful athletes frequently enough, you'll learn to respond to the swoosh as exciting and successful too. This happens in much the same way that Pavlov's dogs learned to salivate to a bell that was originally neutral to them.
ChinaFotoPress/Getty Images; Mike Stobe/Getty Images

But I don't salivate when I see a Nike swoosh. I don't have any reaction at all.

Your response may not be as obvious as the dogs' response to the bell, but if you find yourself responding more positively to Nike shoes and clothes than you would to the same items without the swoosh, you've been conditioned. Of course, the Nike swoosh is just one example. You may also have immediate reactions to shirts with the Polo Ralph Lauren logo, purses with the Chanel logo, or coats with The North Face logo. ●

Over time, you have learned that the *pffst* sound is consistently followed by the cold, sweet sensation of the soda on your tongue. Just as Pavlov's dog's experienced *bell–food*, *bell–food*, *bell–food*, you experienced *pffst–soda*, *pffst–soda*, *pffst–soda*. As a result, the *pffst* sound has transformed from a neutral stimulus (*pffst*) to a conditioned stimulus, and your salivation in response to the *pffst* sound is the conditioned response.

Other examples of classical conditioning are all around us. Many examples, like the soda, involve associations with food or drink; think about your conditioned responses to the sight of a Snicker's candy bar wrapper or to the sound of ice cubes landing in a glass.

Many others involve associations to sex. For example, consider high heels. Many people find high heels sexy, but high heels are not naturally sexy. In fact, without classical conditioning, high heels are just another pair of shoes. With classical conditioning, however, after high heels are repeatedly paired with sexy people, high heels

unconditioned response
The automatic response to a stimulus that occurs naturally, without any need for learning.

conditioned stimulus
A formerly neutral stimulus that now causes a response because of its link to an unconditioned stimulus.

conditioned response
The response to a conditioned stimulus acquired through learning.

become a conditioned stimulus rather than a neutral stimulus. The same can be true for any number of sights (certain kinds or brands of clothes), sounds (certain music), or smells (certain colognes or perfumes). If these things get paired with sex, they become a little bit sexy themselves, and in some cases can become fetishes (Darcangelo, 2012; Hoffman et al., 2004; Lalumiere & Quinsey, 1998). One study found that heterosexual men can even get turned on by the sight of a jar of pennies after it has been paired with photos of attractive nude women (Plaud & Martini, 1999). Another study found that simple black-and-white cartoon drawings that were initially rated as neutral became sexually stimulating to women after they repeatedly viewed the drawings while sexually aroused (Both et al., 2011).

Processes Related to Classical Conditioning

Once Pavlov established the basics of classical conditioning, he examined a variety of processes related to it so he could better understand exactly how it works (Fancher & Rutherford, 2012; Windholz, 1997; Babkin, 1949).

Generalization and Discrimination. For example, Pavlov noticed that a dog conditioned to salivate to a particular bell might also salivate to another bell as long as the sound of the second bell was close enough to the sound of the first one. In other words, the dog might exhibit **generalization**: the process by which stimuli that are similar to the conditioned stimulus cause the same conditioned response. On the other hand, if the dog detected that the second bell's sound was quite different from the first bell's sound, the dog would not salivate to the second bell at all. This illustrates **discrimination**: the process by which stimuli that are different from the conditioned stimulus fail to cause the same conditioned response.

Generalization and discrimination are complementary processes. When generalization stops, discrimination begins (Wyrwicka, 2000; Brown, 1965). A classic study (Shenger-Krestovnikova, 1921, as described in Gray, 1979, 1987) illustrates the extent to which animals can learn to discriminate between stimuli even when they are remarkably similar (**Figure 6.3**). First, dogs were shown a circle immediately before receiving food. As a result, the dogs began salivating to the sight of the circle. They were

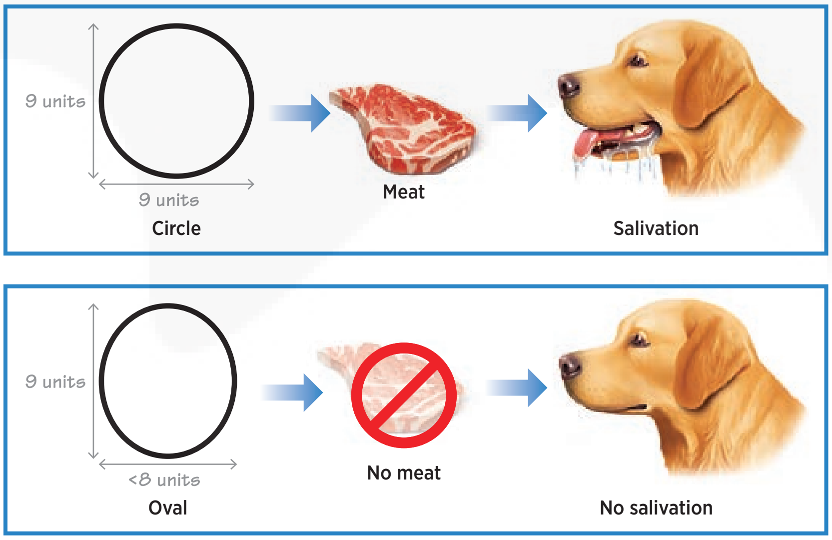


FIGURE 6.3 Generalization and Discrimination In a classic study of generalization and discrimination, dogs learned to respond differently to very similar shapes (a circle and a nearly circular oval). Those two shapes served as meaningful predictors to the dogs: the circle meant that food was coming, but the oval did not (Shenger-Krestovnikova, 1921, as described in Gray, 1979, 1987).

generalization
The learning process by which stimuli that are similar to the conditioned stimulus cause the same conditioned response.

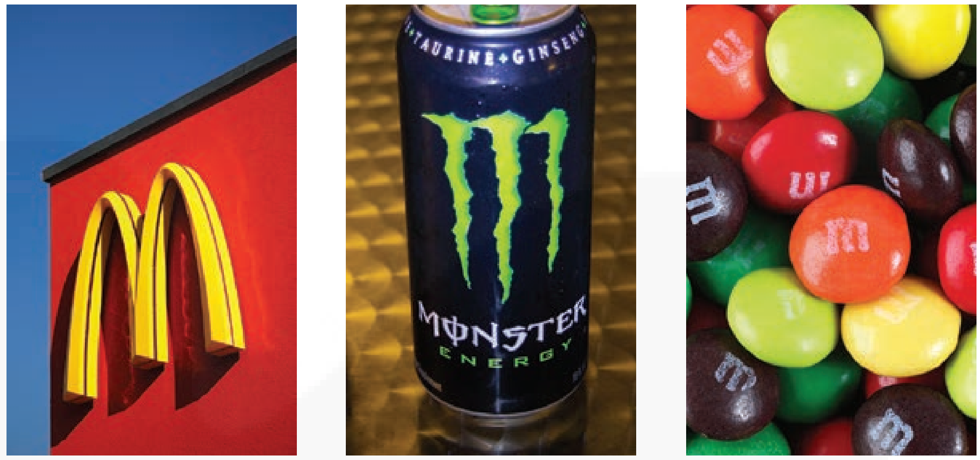
discrimination
The learning process by which stimuli that are different from the conditioned stimulus fail to cause the same conditioned response.

IT'S LIKE ...

Dogs Discriminating Between Similar Shapes Are Like You Discriminating Between Similar Logos

Dogs viewing the circles and nearly circular ovals learned to discriminate between those two shapes only when the difference between the two stimuli became *meaningful* to them (Shenger-Krestovnikova, 1921, as described in Gray, 1979, 1987). At first, the dogs generalized. They salivated to both circles and ovals, presuming that since circles predicted food, ovals would too. Only when their experience taught them that circles predicted food but ovals did not did discrimination become important.

Our own discrimination behaviors are a lot like those of the dogs in that study. We discriminate more when the difference between items means a lot to us. Think for a minute about the number of times in a typical day that you make important distinctions between things that appear alike but have different meanings to you. In the parking lot, your blue Ford Focus looks just like the other three blue Ford Focuses, but a quick check of the cars' details (trim color, dings, license plate) makes it obvious which is yours. Your phone, your laptop, your wallet—they probably look a lot like many others', but you zoom in on the particulars of your items because they mean so much to you. When the difference between the items doesn't mean that much—two nearly identical empty carts at the grocery store, for example—you might not discriminate between them at all.



We often generalize what we've learned, but when slight differences between stimuli suggest big differences in terms of their meaning, we often discriminate instead. McDonald's, Monster, and M&Ms all share M logos, but those M's mean very different things—french fries versus energy drink versus candy—so discriminating between them happens easily. (Left to right) JOKER/Erich Haefele/ullstein bild via Getty Images; Karen Bleier/AFP/Getty Images; © Ekaterina Minaeva/Alamy

The same rules of discrimination apply to your responses to the many logos you see every day. You associate each of them with a distinct product or place (at least you should, if the advertisers have done their jobs well). Some are similar to each other, but you will discriminate between them and react in different ways if they represent things that hold some meaning in your life. Consider the three logos shown all consist of nothing but the letter M, but you probably find yourself reacting differently to each. One M means fries, one M means candy, and one M means energy drink. At one point, none of them meant anything to you. Only when each logo was paired with the product it represents did you begin to discriminate it from the other M's of the world.

then shown an oval (taller than it was wide) immediately before receiving food, and as expected, salivated to that too. The dogs generalized what they learned about the circle to another figure that resembled a circle. The researchers then presented the circle and the oval many more times, but with an important difference: the circle was always followed by food, but the oval was never followed by food. The dogs soon learned to discriminate: they continued to salivate to the circle but stopped salivating to the oval. Finally, the experimenters showed the dogs new ovals that were closer and closer to the shape of a circle. The dogs only began to salivate to the oval when the oval's height became very close to its width—specifically, when the height-to-width ratio was 9 to 8—but not any sooner.

One of the most famous—and controversial—studies in the history of psychology attempted to explore the generalization and discrimination processes in classical conditioning. It was conducted by John B. Watson, a U.S. psychologist who promoted the results of Pavlov's studies in the United States in the early 1900s in the form of *behaviorism* (Watson, 1913, 1914; Buckley, 1989; Benjafield, 2015). In his 1920 Little Albert study, Watson and his student, Rosalie Rayner, worked with an 11-month-old baby boy. Sitting on the floor with him, they presented Albert with a variety of things to see and touch. Among them was a white rat, to which Albert showed no fear at all. In fact, he seemed rather curious about it, reaching his hand out to touch it. However, the next time they presented the white rat to Albert, Watson made a sudden, loud noise

In the Little Albert study (which would not be allowed by today's ethical standards), a baby boy was classically conditioned to fear one white fuzzy thing (a rat), and then he generalized his fear to other white fuzzy things. He discriminated, or did not feel fear of, things that were not white and fuzzy. The Drs. Nicholas and Dorothy Cummings Center for the History of Psychology, The University of Akron

right behind Albert's head by whacking a steel bar with a hammer. Of course, Albert's natural reaction to the loud noise was fear, illustrated by his immediate startle response and crying. Watson then repeated the pairing—*rat–noise*, *rat–noise*, *rat–noise*—until he eventually presented the rat by itself. As you might expect, Albert began to cry and show fear of the rat—the same one he had earlier not feared at all, thanks to the association it now had with the scary noise.

This was a vivid early example of classical conditioning, but the part most relevant to the idea of generalization and discrimination was that Albert began to fear objects similar to the white rat. Almost anything that Watson or Rayner presented that was white and furry like the rat made Albert cry, including a rabbit, a dog, a fur coat, and even (to some extent) Watson's own hair. However, items that did not resemble the white rat, such as toy blocks, caused no negative reaction in Albert at all. He reacted positively to them, just as he had before any conditioning took place. In other words, Albert showed generalization by fearing things that were furry and white (like the rat), and he showed discrimination by *not* fearing things that were *not* furry and white.

It is important to emphasize that the methods Watson and Rayner used would never be approved by ethics boards today. Their treatment of Little Albert caused far too much harm to the participant to justify its use. In fact, this methodology has been the subject of significant controversy, not only for the way Watson and Rayner conditioned this infant but also for the fact that they did nothing afterward to try to reduce the fears they had created (Fridlund et al., 2012). Indeed, studies of this type sparked the movement toward institutional review boards put in place to examine and possibly prohibit potentially risky or unethical studies before they can be conducted (Rosnow et al., 1993; Ceci et al., 1985).

Acquisition. In addition to generalization and discrimination, Pavlov identified particular components of the classical conditioning process. For example, he recognized that there is a particular moment when the animal initially makes the link between the two stimuli (Gleeson, 1991). We call this **acquisition**: the point in the learning process at which the neutral stimulus becomes a conditioned stimulus because it causes the conditioned response. An important point regarding acquisition is that it is based on the ability of one stimulus to *predict* the other. Specifically, the conditioned stimulus (formerly the neutral stimulus) predicts the unconditioned stimulus. For Pavlov's dogs, the bell predicts the food. For Jenny, a red sports car predicts ice cream. As with any prediction, it makes sense only if the order of events is correct. If the sequence were reversed—if the dogs heard the bell *after* they received food or if Jenny saw a red sports car *after* she ate ice cream—then the neutral stimulus would not serve as a predictor, and conditioning would be far less likely to occur (Rescorla, 1988a,b).

Acquisition happens when a neutral stimulus becomes a conditioned stimulus because it is paired with a conditioned response. For example, if you give your dog a new food shortly before it gets a painful shot, it may acquire a learned connection between that food and the feeling of pain. VP Photo Studio/Shutterstock

For acquisition to take place, it is also important that the two stimuli happen within a very brief time of each other. If a long delay separates the neutral stimulus from the unconditioned stimulus, the two may never become associated with each other, so learning may never take place. Remember the study in which men became sexually turned on by a jar of pennies after it was paired with photos of attractive naked women? The researchers got those results by presenting the photos *immediately* after the pennies (Plaud & Martini, 1999). If they had allowed significant time to pass between the pennies and the photos, the link between the two might not have been made, and the pennies would not have caused arousal. Similarly, imagine that you give your dog a new kind of food before the dog gets a painful shot at the vet's office. The dog is much more likely to associate the taste of the food with the pain of the shot if only 5 seconds, rather than 5 hours, separate the two events.

Extinction. At the other end of the classical conditioning timeline is **extinction**: the point in the learning process at which the conditioned stimulus no longer causes the conditioned response because it is no longer linked to the unconditioned stimulus. To study extinction, Pavlov took dogs that had been conditioned to salivate to the bell, then repeatedly presented the bell without food. Eventually, the bell no longer predicted food. In fact, the bell predicted the absence of food. As a result, the dogs stopped salivating to the bell, and the conditioned response was extinguished.

As an example of extinction in humans, consider David, an 8-year-old boy who loves Hershey bars. In fact, just as Pavlov's dogs learned to salivate to the sound of a bell, David learned to get excited at the mention of the word *Hershey*. However, David's response to the word *Hershey* changed when his family moved to the town of Hershey, Pennsylvania. In his new town, David saw and heard the word *Hershey* every day in ways that were decidedly *not* exciting: the Hershey bus station, Hershey High School, Hershey Medical Center, and Hotel Hershey. With all of these new experiences, the word *Hershey* no longer predicted the excitement of a chocolate treat for David. Over time, David's response of excitement to the word *Hershey* became extinct.

***Extinct* sounds so permanent. Once extinction happens, is that learning gone forever?**

Spontaneous Recovery. Not exactly. The learned association between the two stimuli seems to be hidden rather than deleted entirely. We know this because of Pavlov's discovery of **spontaneous recovery**: after a temporary period of inactivity, the return of a conditioned response that had become extinct. After he extinguished the dog's conditioned response of salivating to the bell, Pavlov waited awhile (several hours at least) and then presented the bell again. The dog salivated—not as much as it had when the bell–food connection was at its strongest but certainly more than it had before the bell was ever paired with food. This response suggests that the dog, after the pause, is unsure whether the bell predicts food, as it once did, or the absence of food, as it did more recently. As a result, the dog's response falls somewhere between those two extremes (Falls, 1998; Pavlov, 1927, 1928; Rescorla, 1997).

Spontaneous recovery happens to people too. Consider Ron, a 55-year-old man who just helped his elderly mother move into Autumn View, an assisted living facility. Ron programs his phone with customized rings, and he chose the old-fashioned *brrrringgg* of analog phones for Debbie, the director of Autumn View. The first few times Debbie called Ron, the news was alarming: his mother had fallen and injured her arm; his mother was having trouble breathing; his mother was experiencing chest pain. Soon, via classical conditioning, Ron was responding to Debbie's *brrrringgg* with panic before he even answered the phone. However, the next several calls from Debbie were not alarming at all. In fact, they were quite mundane: a call to let Ron know he had left his jacket there when he last visited, a reminder about an upcoming Mother's Day party at the facility, a minor question about the bill. Soon, the *brrrringgg* that had predicted panic was predicting, well, not much at all. At that point, Ron's panic response to the *brrrringgg* became extinct. He reacted to that ring no differently than to any other ring. He then received no calls from Debbie for a quite a while, until one morning he heard the *brrrringgg* for the first time in weeks. Ron reacted with mild anxiety—not the full-fledged panic he had felt after the first few calls from Debbie, but certainly more anxiety than he would have felt if he had never associated her ring with alarming news.

Higher-Order Conditioning. Pavlov also found that sometimes during classical conditioning, the number of associated stimuli is not limited to two. The stimuli can be linked in a chain of three or more. This is called **higher-order conditioning**: classical conditioning that involves three or more stimuli. (Higher-order conditioning is also known as *second-order conditioning* [Holland & Rescorla, 1975; Nairne & Rescorla, 1981; Rescorla, 1976, 1980].) Specifically, a learning process in which a conditioned stimulus from a previous learning process serves as an unconditioned stimulus, producing a new conditioned stimulus that causes the same conditioned response.

acquisition
The point in the learning process at which the neutral stimulus becomes a conditioned stimulus because of its link to the conditioned response.

extinction
The point in the learning process at which the conditioned stimulus no longer causes the conditioned response because it is no longer linked to the unconditioned stimulus.

spontaneous recovery
After a temporary period of inactivity, the return of a conditioned response that had become extinct.

higher-order conditioning
Classical conditioning that involves three or more stimuli.

CHAPTER APP 6.1

Classical Conditioning

Aqualert Water Reminder

Preview one of the links and consider the following questions.

WEBSITE:
http://tiny.cc/t9g7jy

ANDROID:
http://tiny.cc/3igyiy

IPHONE:
http://tiny.cc/vigyiy

VIDEO DEMO:
http://tiny.cc/chapterapps

This app is designed to help you drink sufficient amounts of water throughout the day. You input your personal information (weight, sex, activity level) and the app helps you develop a schedule for how much water you should drink. At scheduled times, you hear alerts sent by the app that remind you to drink water. It also gives you feedback on your water consumption, allowing you to track your progress.

How does it APPly to your daily life?
Think about the way Pavlov's dogs learned through *classical conditioning* to salivate to the sound of a bell when it was followed by food. What do you think will happen if *you* use this app in which the sound of the alert is followed by water? Does some version of this classical conditioning already happen in your day-to-day life? Have certain sounds (or sights or other stimuli) become predictors of certain foods or drinks?

How does it APPly to your understanding of psychology?
There are four essential parts of classical conditioning for the Pavlov bell–food studies: the *unconditioned stimulus*, the *unconditioned response*, the *conditioned stimulus*, and the *conditioned response*. Can you identify those four parts of classical conditioning from your experience with this app?

Let's think again about the way the *pffst* of opening a soda causes you to salivate. As a reminder, this response is caused by the fact that you have repeatedly heard the sound right before you taste the soda. That's a two-step process (*pffst–soda*), but could it be extended to three steps? In other words, is there another stimulus that repeatedly happens right before (predicts) the *pffst* sound? If you typically get your soda from a vending machine, the thud sound that the can makes as it falls to the machine's opening could be that third stimulus. In this three-step sequence—*thud–pffst–soda*—the thud predicts the *pffst*, and the *pffst* predicts the soda. With enough repetition, the thud produces a salivation response. The sequence could even be extended to four steps if we consider the sound of the coins dropping into the slot at the beginning of the process, such that the sound of the coins dropping causes salivation through a *coins–thud–pffst–soda* connection.

Vicarious Conditioning. A final note on classical conditioning: it can happen to you because of what you see happening to the people around you in addition to what happens directly to you. We call this **vicarious conditioning**: conditioning that takes place via observation of others' life experiences rather than one's own. Jenny—whose Uncle Joe takes her out for ice cream in his red sports car—has a close friend named Seiko. Jenny has told Seiko stories about how Uncle Joe takes her for ice cream in his red sports car, and in fact, once Seiko was at the ice cream shop herself when she saw Jenny and Uncle Joe pull up. On several occasions, Seiko has been playing with Jenny in her front yard when a red sports car drives by, and she has noticed Jenny's excitement when she sees it. Now, if Seiko happens to see a red sports car before Jenny does, she gets excited too—even though she's never actually ridden in a red sports car.

Applying Classical Conditioning to Your Life

Classical conditioning is often an important part of efforts to improve people's lives. For example, psychologists use principles of classical conditioning to help clients overcome *phobias*. Phobias are strong, irrational fears of a particular thing or situation. Most psychologists believe that a phobia is produced by a learned pairing of a specific thing with an extremely unpleasant feeling, so the best way to overcome a phobia is to break that pairing (Hazlett-Stevens & Craske, 2008; Spiegler & Guevremont, 2010). For example, consider Teresa, a young woman with a phobia of buses, which developed after she was robbed on a bus. She learned to avoid buses through her experience of the bus–robbery pairing, which is problematic because she needs to take a bus to her job. Her psychologist, Dr. Sumule, helps Teresa overcome her phobia by encouraging her to gradually expose herself to buses—getting near them, then getting on them briefly, then staying on for longer periods. As she does, she repeatedly finds that the learned pairing of the bus with the robbery doesn't occur. In other words, Teresa experiences the bus without the fear of robbery. As she spends more time on buses *without* being robbed, Teresa's phobia diminishes and gradually becomes extinct. (We'll discuss phobias and their treatment in much more detail in the chapters on disorders and treatment.)

Classical conditioning can be used in the treatment of physical disorders too. The basic idea is that if a drug improves a disorder, what's paired with that drug can bring about similar improvement. It's just like Pavlov's dogs, which learned to salivate to a bell because the bell had been paired with food, but for human beings, the reaction can take other physical forms (Ader & Cohen, 1982; Cohen et al., 1994; Longo et al., 1999; Exton et al., 2000).

For example, in studies of patients with serious airborne allergies, patients took an effective allergy drug and then immediately drank a very unusual drink—let's imagine it is pineapple soda. After this pairing of effective drug with pineapple soda was repeated a number of times, the researchers gave the patients the pineapple soda by itself. The patients' reactions to the pineapple soda by itself was similar to their reactions to the effective allergy drug with which it had been paired. Not only did the

vicarious conditioning
Conditioning that takes place via observation of others' life experiences rather than one's own.

operant conditioning
A form of learning in which the consequences of a voluntary behavior affect the likelihood that the behavior will recur.

patients describe similar improvements in their allergy symptoms, their bodies had similar physiological reactions in terms of producing antibodies, as well. The formerly neutral stimulus of pineapple soda had come to have a medical effect in these patients because of its learned association with a drug that did have a medical effect (Gauci et al., 1994; Goebel et al., 2008).

This research raises the question of the power of *placebos*, medically inactive substances that somehow have a positive effect on patients (Vits et al., 2011). In one study, researchers treated patients with psoriasis, a common skin disease in which the elbows, knees, or other areas become very red and itchy. At first, all patients were treated repeatedly with an ointment that had a unique smell and color. The ointment contained a steroid as its active ingredient. Then the patients were divided into two groups. (They did not know which group they were in.) Group 1 continued to get the exact same ointment they had been using, including the steroid. Group 2 got the same ointment too, but theirs only contained the active ingredient 25% to 50% of the time. As you would expect, Group 1 got better. Specifically, 78% of them were cured of their psoriasis. The second group—whose ointment *lacked the medicine* most of the time—got better at almost the same rate (73%). Through classical conditioning, the patients in Group 2 had learned the pairing of the steroid with the unique smell and color of the ointment. The pairing was so strong that the smell and the color of the ointment caused the patients' skin to react as if it were actually receiving the medicine (Ader et al., 2010).

In one study, ointment for a skin disease continued to work even after the active ingredient (a steroid) was removed (Vits et al., 2011). This result illustrates the power of classical conditioning: The other features of the ointment—smell, color, and so on—were paired with the active ingredient closely enough to produce a medicinal effect by themselves. Suze777/iStock/Getty Images

CHECK YOUR LEARNING:

6.4 Who was Ivan Pavlov, and why is his research with dogs important?

6.5 What is classical conditioning, and how commonly does it occur in your life?

6.6 What are the five main components of classical conditioning?

6.7 With regard to classical conditioning, what do generalization and discrimination mean?

6.8 With regard to classical conditioning, what do acquisition and extinction mean?

6.9 What is higher-order conditioning?.

6.10 How does learning take place through vicarious conditioning?

Operant Conditioning

You may have noticed that learning via classical conditioning is quite passive. In Pavlov's classic studies, the dogs weren't really *doing* anything voluntarily. Things were being done *to* them. Food was placed near their mouths and bells were rung in their ears, but the dogs' role was simply to stand there and demonstrate any natural involuntary reflexes that might occur (salivation).

Often, learning is a more active process. In these moments, we learn by connecting what we do with what happens to us as a result. Psychologists call this **operant conditioning**: a form of learning in which the consequences of a voluntary behavior affect the likelihood that the behavior will recur. The word *operant* shares its root with the word *operate*, so *operant conditioning* refers to what you learn when operating on the environment around you (Flora, 2004). As you operate on your environment, you develop your own personal if–then statements that explain past behavior and govern future behavior. These if–then statements are called *contingencies*. Here are a few examples of contingencies: (1) If I run outside without shoes, then I get a cut on my foot. (2) If I answer the phone when my friend Steve calls, then I laugh at his jokes. (3) If I blow off my math homework, then I bomb the test.

YOU WILL LEARN:

6.11 what operant conditioning is.

6.12 how operant conditioning relates to the law of effect.

6.13 who B. F. Skinner was and why his research on operant conditioning was important.

6.14 how psychologists define reinforcement.

6.15 the differences between various types of reinforcement.

6.16 the differences between various schedules of reinforcement.

YOU WILL LEARN: *(Continued)*

6.17 how psychologists define punishment.

6.18 how discriminative stimuli affect operant conditioning.

6.19 how shaping takes place.

6.20 the relevance of some classical conditioning concepts to operant conditioning.

If one of Pavlov's dogs had whimpered and then received a treat or scratched at the door and then received a smack, perhaps Pavlov would have focused on operant conditioning rather than classical conditioning. As it happens, though, operant conditioning has a different pioneer: Edward L. Thorndike. Thorndike was a U.S. psychologist who conducted many studies on animal behavior in the late 1800s and early 1900s (Thorndike, 1898, 1900). In the best known of these studies, he placed cats inside a small box he called a puzzle box. As **Figure 6.4** illustrates, the cat could open the door to the puzzle box by performing a particular behavior, such as stepping on a button on the box's floor or pulling on a weight hanging from the box's ceiling, much like the pulls on overhead ceiling fans. Thorndike gave the cats food when they escaped, and he timed how long it took them to do so. He found that the first escape took quite a while as the cats moved randomly around the box, but each additional escape took a shorter and shorter time. Through trial and error, the cat seemed to be learning: if I step on this button, then the door opens and I get to exit and eat.

Thorndike said that the cats were demonstrating the **law of effect**: the observation that a behavior is more likely to be repeated if its effects are desirable but less likely to be repeated if its effects are undesirable (1911, 1927). It's a simple but powerful rule by which we all (animals and people) live: we pay attention to the outcome of each of our actions. If we like the outcome, we will probably repeat that action; if we don't like the outcome, we probably won't repeat the behavior.

B. F. Skinner: Operant Conditioning for Everyone

B. F. Skinner was a psychology professor at the University of Minnesota, Indiana University, and Harvard. Inspired by Thorndike, Skinner spent his career conducting extensive studies on animal behavior, trying to expand what we know about the law of effect and operant conditioning (Mills, 1998; Richelle, 1993). While Thorndike's work remained relatively unknown to most people outside of academia, Skinner's work made him a household name. By the 1960s and 1970s, Skinner was as much of a rock star as a psychology professor could be: he frequently appeared on TV talk shows, wrote two books that sold millions of copies and made the *New York Times* bestseller list, was on *Esquire* magazine's 1970 list of the 100 most important people, and was the subject of a cover story in *Time* magazine in September 1971 (Rutherford, 2009; Smith, 1996; Mills, 1998). Most of Skinner's fame stemmed from his ability to apply his findings about animal behavior to human behavior. Perhaps the most controversial of these was that *all* behavior is determined by its consequences, so we have no free will to act as we want. This claim—which may be easier to accept for other animals than for humans—remains controversial today (Altus & Morris, 2009; Baer et al., 2008).

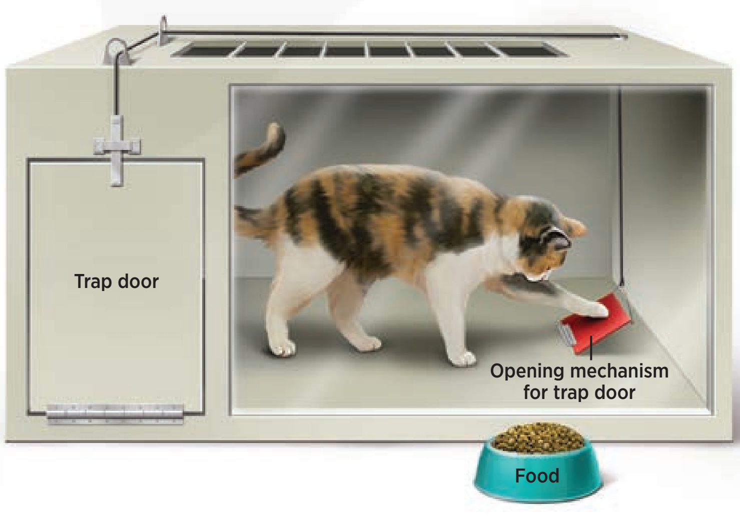


FIGURE 6.4 Thorndike's Puzzle Box When Edward Thorndike placed hungry cats inside puzzle boxes, they learned which behaviors caused the door to open and allowed them to eat the food outside. Thorndike explained that the cats' learning process illustrated the law of effect, or the idea that a behavior is likely to be repeated if its outcome is desirable but unlikely to be repeated if its outcome is undesirable (Thorndike, 1911, 1927).

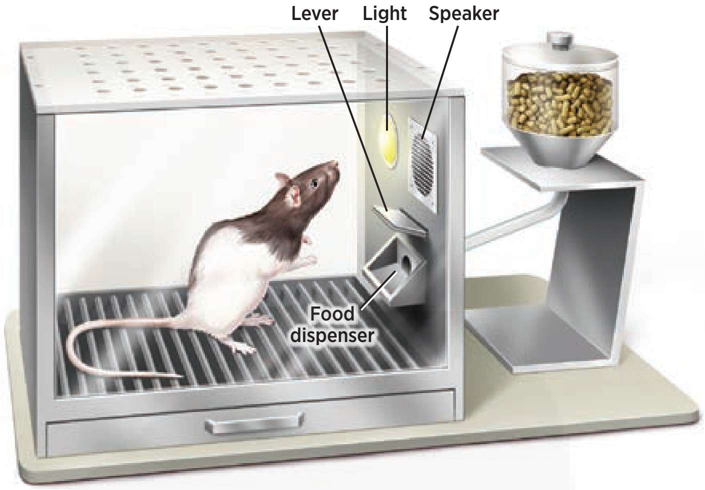


FIGURE 6.5 Skinner Box B. F. Skinner's Skinner boxes (or operant chambers) were new and improved versions of Edward Thorndike's puzzle boxes. They allowed animals to bring food or water into the box by pressing a lever or button. Also, because the boxes were wired for electricity, they could automatically record the frequency of animals' behavior and control lights that indicated whether a reward was available at a particular time.

Skinner's first step as a researcher was to improve Thorndike's puzzle box. The **Skinner box** (originally called an *operant chamber*) is a container into which animals such as pigeons or rats could be placed for the purpose of observing and recording their behavior in response to consequences (**Figure 6.5**). Many of the advantages of the Skinner box had to do with automation and the use of electricity. For example, it automatically dispensed food or water when the animal pressed the right lever or button. The Skinner box recorded the animal's lever-pressing behavior automatically (through an electrical device), which meant there was no need for a person to observe continuously. And it could use a light to indicate that a reward was available if a behavior was performed. It also kept the animal in the box, so the experimenter didn't have to catch the escaped animal and wrestle it back into the box for another trial (as was required by Thorndike's cats) (Toates, 2009; Ator, 1991).

Reinforcement. With his new boxes, Skinner ran a multitude of studies on how consequences shape actions. The type of consequence upon which he focused most was **reinforcement**: any consequence of a behavior that makes that behavior more likely to recur. In general, reinforcement can be described as anything that helps the animal experience pleasure or avoid pain (Flora, 2004; Donahoe, 1998). Usually, what's reinforcing to one member of a species is reinforcing to all members of that species. But sometimes, what we expect to be reinforcing to a person or animal is not. In other words, reinforcement, like beauty, is in the eye of the beholder. For example, Jodi, a summer camp counselor, offers two 13-year-old girls—Abby and Bianca—peanut butter cookies for cleaning their cabins. Abby finds cookies reinforcing and cleans her area quickly. Bianca, on the other hand, is allergic to peanuts, so she does not find the cookies reinforcing at all and the offer does not motivate her to clean up.

Reinforcement can be categorized in many ways. For example, it can be labeled as either *positive* or *negative*. **Positive reinforcement** involves getting something desirable. **Negative reinforcement** involves removing something undesirable. Keep in mind that both of these are reinforcement, which means that they both increase the likelihood of the behavior happening again in the future. Positive reinforcement comes in many forms—for example, a restaurant server receiving a tip for providing good service, a 5-year-old child getting a hug for a successfully tying her shoes, or a college football team being awarded a trophy for winning a bowl game. Negative reinforcement also takes many forms—for example, a homeowner getting rid of bugs by calling an exterminator, a woman stopping harassing phone calls by obtaining a restraining order, or a child overcoming strep throat by taking an antibiotic. Remember that in this context, *positive* and *negative* don't mean good and bad. In terms of reinforcement,

Reinforcement is an essential part of animal training. Dogs learn to fetch, shake hands, roll over, or jump over a bar by associating those behaviors with the reinforcements, such as treats, that come after them. iztok noc/E+/Getty Images

law of effect
The observation that a behavior is more likely to be repeated if its effects are desirable but less likely to be repeated if its effects are undesirable.

Skinner box
(originally called an *operant chamber*) a container into which animals such as pigeons or rats could be placed for the purpose of observing and recording their behavior in response to consequences.

reinforcement
Any consequence of a behavior that makes that behavior more likely to recur.

positive reinforcement
A type of reinforcement that involves getting something desirable.

negative reinforcement
A type of reinforcement that involves removing something undesirable.

positive means plus (plus something desirable, to be specific) and negative means minus (minus something undesirable, to be specific).

Primary and Secondary Reinforcers. Reinforcement can also be categorized as either *primary* or *secondary*. A **primary reinforcer** is an innate reinforcer that requires no learning to have a reinforcing effect because it satisfies a biological need. A few basic things serve as primary reinforcers, not only to humans, but to most species, because they have value to keep us alive and healthy: food, water, physical touch, sex, reduction in pain or discomfort. Through your life experience (and classical conditioning), you come to associate other stimuli with those core primary reinforcers.

We call a stimulus that has been paired with a primary reinforcer a **secondary reinforcer**: a reinforcer that requires a learned link to a primary reinforcer to have a reinforcing effect. Money is the ultimate secondary reinforcer (Delgado et al., 2006). Any value that a rectangular green piece of paper or a small silver circle may have to you is something that you had to learn. You weren't born with an appreciation for dollar bills and coins. For example, picture two children, a 1-year-old and a 12-year-old. Grandma gives them identical Amazon.com gift cards. The 12-year-old reacts with excitement. She has learned, through her experience, that the gift card can be exchanged for books, music, toys, and lots of other cool stuff online. The 1-year-old tries to eat the gift card for a minute and then discards it with great indifference. To him, a gift card is not yet linked to the fun things it can bring, so it hasn't become a secondary reinforcer. Plenty of other powerful reinforcers in your day-to-day life are secondary rather than primary reinforcers—from applause to grades to plaques.

Another example of secondary reinforcement is the use of clickers by dog trainers. Specifically, a dog trainer teaches a dog to perform a behavior (heel, sit, and so on) by following the behavior with not only a treat (primary reinforcer), but also with a click (secondary reinforcer). Soon enough, the dog forms such a strong association between the treat and the click that the click alone becomes a powerful reinforcer (Pryor, 2009). (In fact, a click can be more powerful than typical secondary reinforcers like the praise words *good* or *yes* because dogs overhear people use those words in many contexts, which can confuse them.)

Immediate and Delayed Reinforcement. It is also possible to describe reinforcement as *immediate* or *delayed*. This is an important distinction, as a single behavior can have very different short-term effects and long-term effects. For example, eating a whole pizza can feel like a wonderful indulgence at the time but can cause weight gain (not to mention a stomachache) later on. The second consequence (weight gain and stomachache) should probably outrank the first consequence (good taste of pizza). However, the immediacy of the first consequence paired with the delay of the second consequence can cause you to behave in ways that you later regret. Just imagine if the order of the immediate and delayed reinforcers were somehow reversed. Your behavior would likely change if the weight gain and stomachache came immediately but the good taste of the pizza came days later.

Reinforcement and Diversity What is reinforcing to people from one culture might not be reinforcing to people from a different culture (Spiegler, 2016; Pantalone et al., 2010; Gelfand et al., 2007). For example, consider money. Money is a powerful reinforcer, but different types of money mean different things to different people. Imagine that an American brother and sister shoveled snow from their neighbor's driveway. If the neighbor handed each of them an American $10 bill when they finished, they would probably feel reinforced, and likely would repeat the behavior the next time it snowed. However, if the neighbor handed each of them $10 worth of Japanese yen, Indian rupees, or Swiss francs, they would probably not feel reinforced (unless they could somehow exchange the foreign money for American dollars).

DIVERSITY MATTERS

Individualism and collectivism can also play a role in the way reinforcements are perceived in various cultures. Specifically, awards for individual achievements

CHAPTER APP 6.2

Reinforcement

ChoreMonster

Preview one of the links and consider the following questions.

WEBSITE:
http://tiny.cc/obh7jy

ANDROID:
http://tiny.cc/ejgyiy

IPHONE:
http://tiny.cc/9igyiy

VIDEO DEMO:
http://tiny.cc/chapterapps

There are dozens of apps designed to help you use operant conditioning—and reinforcement in particular—to make changes to your (or your kids') behavior. For example, ChoreMonster is an app that helps parents reinforce their kids for specifically chosen behaviors. The parent lists the particular behavior for each kid: taking out the trash, doing the dishes, walking the dog, brushing teeth, etc. The parent also decides how many points the kid earns for completing the behavior, and what those points can be exchanged for: TV time, computer time, dessert, allowance, etc. Kids can even check chores off the list themselves with their own version of the app.

How does it APPly to your daily life?
What are the most important decisions for the parent using this kind of operant conditioning app: the number of points each chore is worth, the specific reinforcements that the kid is working toward, the exchange rate between points and reinforcements, or something else? If you were the kid, which of these factors would have the most powerful influence on your behavior?

How does it APPly to your understanding of psychology?
Consider what you've learned about shaping, or the way people can gradually learn a complex behavior by reinforcing each of its small steps. If your parents had used an app like ChoreMonster when you were a kid, would it have helped them shape your behavior? If you are a parent yourself, how effectively could you use an app like this to shape your own kids' behaviors?

are often more well-received in cultures that emphasize individualism—such as the United States, Australia, and some European countries—than in cultures that emphasize collectivism—such as many Asian, Hispanic, and Native American groups (Nelson, 1995; Baruth & Manning, 1992; Kallam et al., 1994). In fact, among more collectivistic cultures, a person who is singled out for an individual award might be teased or belittled by his or her peers for standing out from the crowd. For teachers, coaches, employers, or anyone else who might use reinforcements to influence the behavior of people from diverse backgrounds, this is an important point to keep in mind (Moran et al., 2014; Pierangelo & Giuliani, 2008).

Speaking of employers and reinforcements, one study asked undergraduate business students in three countries (United States, Australia, and Mexico) what they would find most reinforcing about a job offer. There were some common preferences, including good pay and recognition for high levels of performance. But there were some differences between the groups too. In particular, Mexican students expressed stronger preferences for the opportunity to get jobs for their relatives and the opportunity to contribute to society and the well-being of others. These preferences may reflect the fact that Mexico is generally more collectivistic and less individualistic than either the United States or Australia (McGaughey et al., 1997). Another study of undergraduate students from different countries (this time, the United States and Chile) found differences between cultures and differences between genders. Specifically, compared to men, women from both countries placed more reinforcement value on good working conditions and convenient working hours (Corney & Richards, 2005).

A study of high school students' perceptions of reinforcements covered an even broader range of cultures (Homan et al., 2012). The researchers asked 750 teenagers from 7 countries (United States, Australia, Tanzania, Denmark, Honduras, Korea, and Spain) to rate dozens of activities, including sports, social activities, Internet use, games, and sleep on a scale of 1 to 5. Higher scores meant that they found the activity more rewarding. There were some consistencies across cultures, but the results showed plenty of cultural differences. For example, in Tanzania, shopping received the highest rating of all but shopping didn't rate higher than 8th in any other country. In Honduras, visiting relatives was the second-highest rated activity, but its rating was nowhere near as high in any other country. In Denmark, downhill skiing was the highest-rated sport, but it didn't crack the top 5 sports of any other country. In the United States, the top five sports included two (American football and fishing) that didn't appear in the top five of any other country. Soccer, on the other hand, did not make the American top 5, but it made the top 5 in most other countries. The lesson here is that the reinforcement value of any particular item or activity can depend on the cultural background of the person who receives it.

Schedules of Reinforcement

When it comes to reinforcement, timing is everything. The simple distinction between immediate and delayed reinforcement is just the beginning (Lattal, 1991). Indeed, Skinner identified a variety of specific **reinforcement schedules**: patterns by which reinforcements occur in response to a particular behavior. The basic distinction is between *continuous* and *partial* reinforcement. **Continuous reinforcement** is a pattern by which a behavior is reinforced every time it occurs. By contrast, **partial reinforcement** (also known as *intermittent* reinforcement) is a pattern by which a behavior is reinforced only some of the time. For example, let's say a father (Alex) wants his teenage son (Zach) to take over the chore of cutting the grass. If Alex takes Zach out to his favorite restaurant for dinner every day Zach cuts the grass, that's continuous reinforcement. If Alex takes Zach out to his favorite restaurant only on some of the days Zach cuts the grass, that's partial reinforcement.

The distinction between continuous and partial reinforcement is important in terms of *acquisition* and *extinction*, which we mentioned earlier. (Those terms appeared in the section on classical conditioning, but they apply to operant conditioning as well.)

MY TAKE VIDEO 6.2

Reinforcement Schedules

"I would personally check social media less if..."

YOUTUBE: http://tiny.cc/mytake
LAUNCHPAD: launchpadworks.com

People from one culture may value a reinforcement more or less than people from another culture. In one study, high school students indicated how reinforcing they found various activities, including sports. In many countries, soccer was near the top of the list. In the U.S., however, soccer ranked much lower. Some countries featured a sport (or two) high on their list that didn't appear on other countries' lists at all (Homan et al., 2012). Christian Bertrand/Shutterstock

primary reinforcer
An innate reinforcer that requires no learning to have a reinforcing effect because it satisfies a biological need.

secondary reinforcer
A reinforcer that requires a learned link to a primary reinforcer to have a reinforcing effect

reinforcement schedule
A pattern by which reinforcements occur in response to a particular behavior.

continuous reinforcement
A pattern by which a behavior is reinforced every time it occurs.

partial reinforcement
(*intermittent* reinforcement) a pattern by which a behavior is reinforced only some of the times it occurs.

Acquisition happens more quickly with continuous reinforcement—after just a couple of times cutting the grass, Zach will have learned that "If I cut the grass, I get to go to my favorite restaurant" is a hard-and-fast rule. But continuous reinforcement results in faster extinction too—if Alex forgets to reinforce Zach just once or twice, Zach will realize quickly that the deal is off.

With partial reinforcement, acquisition happens more slowly if at all, because it can be difficult to detect a connection between the behavior and the outcome. But once the connection has been acquired, behaviors on a partial reinforcement schedule are quite resistant to extinction. If Zach has learned that grass cutting leads to eating at his favorite restaurant only some of the time, he won't necessarily quit if he doesn't get rewarded with the restaurant the next time he cuts the grass. He might not even quit after two or perhaps even ten grass cuttings don't bring about the reward. This is because the next grass cutting might still bring the reward. The bottom line is that continuous reinforcement is best for making acquisition happen initially, but partial reinforcement is best for maintaining that behavior over time.

Within the broad category of partial reinforcement, Skinner (1961) identified four more specific reinforcement schedules: *fixed-ratio*, *variable-ratio*, *fixed-interval*, and *variable-interval* (**Table 6.1**). They differ from each other in two important ways—whether the reinforcement is predictable (*fixed*) or unpredictable (*variable*); and whether it is based on the number of repetitions of the behavior (*ratio*) or the passage of time (*interval*)—but these differences can powerfully influence behavior.

Ratio Schedules. A **fixed-ratio schedule** is a reinforcement schedule in which a behavior is reinforced after a consistent, predictable number of occurrences. By contrast, a **variable-ratio schedule** is a reinforcement schedule in which a behavior is reinforced after an inconsistent, unpredictable number of occurrences. Consider soda machines versus slot machines. With a soda machine, you know with great confidence that if you put the money in once and press the button once, you'll get your reinforcement. There's no mystery, no uncertainty—this is an example of a fixed-ratio schedule. With a slot machine, you *don't* know what will happen after you put your money in and press the button (or pull the arm). There *is* mystery and uncertainty—you could get nothing or a little something or a lot. The difference between *fixed ratio* and *variable ratio* is important, particularly in terms of extinction, which is essentially giving up on the possibility that your behavior will bring about the reward. With the soda machine, if you put in your money, press the button, and get nothing, you are extremely unlikely to insert money even once more. But with the slot machine, if you put in your money, press the button (or pull the arm), and get nothing, you may insert money again and again, because you know you might hit the jackpot on the next try (Horsley et al., 2012).

Interval Schedules. A **fixed-interval schedule** is a reinforcement schedule in which a behavior can be reinforced after a time interval that is consistent and predictable. By contrast, a **variable-interval schedule** is a reinforcement schedule in which a behavior can be reinforced after a time interval that is inconsistent and

fixed-ratio schedule
A reinforcement schedule in which a behavior is reinforced after a consistent, predictable number of occurrences.

variable-ratio schedule
A reinforcement schedule in which a behavior is reinforced after an inconsistent, unpredictable number of occurrences.

fixed-interval schedule
A reinforcement schedule in which a behavior can be reinforced after a time interval that is consistent and predictable.

variable-interval schedule
A reinforcement schedule in which a behavior can be reinforced after a time interval that is inconsistent and unpredictable.

punishment
Any consequence of a behavior that makes that behavior less likely to recur.

TABLE 6.1: Summary of Reinforcement Schedules

	FIXED	VARIABLE
RATIO	Reinforcement comes when you perform the behavior a predictable number of times. *Example: soda machine*	Reinforcement comes when you perform the behavior an unpredictable number of times. *Example: slot machine*
INTERVAL	Reinforcement comes when you perform the behavior after a predictable amount of time has passed. *Example: mail*	Reinforcement comes when you perform the behavior after an unpredictable amount of time has passed. *Example: email*

unpredictable. Consider mail versus email. (For the sake of this discussion, let's assume that you find your mail and your email to be equally reinforcing in terms of the amount of pleasure each gives you.) With mail, you know to check your mailbox at a certain time—say, after 2:00 P.M. every day but Sunday. In other words, mail is delivered on a fixed-interval schedule. If you receive your mail at 2:30 P.M. on Monday, will you check the mailbox again at 2:45 P.M.? At 7:00 P.M.? At 9:00 A.M. on Tuesday? Of course not—you know that you can't possibly receive the next batch of mail until Tuesday after 2:00 P.M., so you'll wait until then to check again. (As 2:00 P.M. approaches, you may check quite often, only to stop completely once it arrives.)

Email, on the other hand, doesn't arrive at predictable times. It is on a variable-interval schedule. If you receive your email at 2:30 P.M. on Monday, will you check it again at 2:45 P.M.? You very well might—after all, there's no need to wait until 2:30 P.M. Tuesday, or any other predetermined time, to check. Because you never know when the next reinforcing email might arrive, you are likely to check email far more frequently than you check your snail mail.

Fixed-Ratio Schedule

Variable-Ratio Schedule

Fixed-ratio schedules of reinforcement are like soda machines—what you get after you perform the behavior (in this case, inserting money) is predictable. Variable-ratio schedules of reinforcement are like slot machines—what you get after you perform the behavior (again, inserting money) is unpredictable. The degree of predictability makes a big difference when you decide whether to give up on a behavior (or let it become extinct) when you get nothing. (Left) © Graham Oliver/Alamy; (right) Folio Images/Alamy

Punishment

So far, our discussion of operant conditioning has focused on behaviors followed by reinforcements, but of course, many behaviors are not followed by reinforcement. Many behaviors are followed by **punishment**: any consequence of a behavior that makes that behavior less likely to recur.

Wait, I'm confused. What's the difference between punishment and negative reinforcement?

Many students find the terminology confusing. But there's a simple rule to clarify it: if the term includes the word *reinforcement*, it makes the behavior happen *more* often; if the term includes *punishment*, it makes the behavior happen *less* often, whether it is positive or negative (**Table 6.2**). Like reinforcement, punishment can be positive (getting something undesirable) or negative (removing something desirable). For example, a parent who spanks a child for cursing is using positive punishment. But a parent who takes away a child's handheld video game system is using negative punishment. Of course, both punishments are intended to reduce the cursing behavior.

Some consequences that are meant to be punishments can actually be experienced as insignificant (having no effect on the frequency of the behavior) or even reinforcing (increasing its frequency). A parent who "punishes" a teenager for lying by sending him to his room may not see a reduction in lying behavior if the child's room

Fixed-Interval Schedule

Variable-Interval Schedule

Mail arrives on a fixed-interval schedule—you know exactly how long to wait until its next arrival. Email arrives on a variable-interval schedule—you never know when the next one might arrive. That difference between fixed (predictable) and variable (unpredictable) schedules of reinforcement has powerful influences on the frequency of your behavior. Specifically, it explains why you are likely to check your email more often than your mail. Imagine how the frequency of your email-checking behavior would change if your email were only delivered once per day, like mail. (Left) Huntstock/DisabilityImages/Getty Images; (right) m-imagephotography/iStock/Getty Images Plus

TABLE 6.2: Responses to a Behavior that Influence Its Frequency

	REINFORCEMENT	PUNISHMENT
POSITIVE	*Increase* frequency of behavior by getting something good	*Decrease* frequency of behavior by getting something bad
NEGATIVE	*Increase* frequency of behavior by removing something bad	*Decrease* frequency of behavior by removing something good

includes a TV and computer. A kindergarten teacher who "punishes" a child for hitting a classmate by scolding her in the hallway is also giving the girl plenty of one-on-one attention. The girl may actually find this attention to be a reinforcement rather than punishment.

Drawbacks of Punishment. Skinner and other researchers who have studied operant conditioning warn that the use of punishment to change behavior has quite a few drawbacks that the use of reinforcement doesn't. For example, punishment teaches people (and animals) what behavior to avoid, but not what behavior to choose instead (Lerman & Toole, 2011). Punishment also provides a model of aggressiveness (and in some cases violence) that individuals (especially children) might follow when it is their turn to influence others' behavior. In fact, children who were physically disciplined are particularly likely to become physically aggressive (Gershoff, 2002, 2008, 2010; Gershoff & Bitensky, 2007). And punishment can encourage lying and other kinds of deceptiveness—hiding the punished behavior rather than eliminating it ("I didn't do it!") (Rotenberg et al., 2012).

Punishment can create high levels of anxiety and fear, which can interfere with the desired behavior change. For example, a child punished harshly for failing to take out the trash might withdraw altogether rather than complete the chore. In families where harsh physical punishment is common, children are at greater risk for developing anxiety disorders and other kinds of mental disorders as adults, as illustrated in **Figure 6.6** (Afifi et al., 2012). ("Harsh physical punishment" goes way beyond spanking;

WATCHING PSYCHOLOGY

Home Runs and Schedules of Reinforcement

One of the joys of tuning in to a baseball game on TV is the thrill of the home run. Some sluggers deliver the long ball at an amazing rate—a feat measured by the statistic at-bats per home run. This number reflects the average number of plate appearances you'd have to wait to see a particular batter send one over the fence.

Babe Ruth, Mark McGwire, and Barry Bonds are at the top of the all-time list for at-bats per home run. Among more current players, one of the best is Mike Trout. Throughout his career, Trout has earned a ratio of about 17:1. So as a fan, you have a 1 in 17 chance of seeing a homer when Trout steps to the plate.

Now think about how important the schedule of reinforcement is to baseball-viewing habits. You can't predict when Mike Trout will hit his next homer. His home runs reinforce you on a *variable-ratio* schedule. You have a general idea that he hits one about once every 17 at-bats (or one every 3 or 4 games), but you can't know which at-bats specifically will produce a home run. Let's imagine that you are a huge fan of Mike Trout and his home runs. In fact, they're the main reason you watch the game. If he hits a homer in the first inning, will you continue to watch the game? Of course! He might hit another in a later inning. If he hasn't hit one in a week, will you watch? Of course! He could smash a home run (or even 2 or 3 of them) tonight. Because the schedule of reinforcement is variable, you keep watching.

Now imagine if Mike Trout's home runs were delivered on a *fixed-ratio* schedule instead of a variable-ratio schedule. He still hits them at the same rate—1 home run every 17 at-bats—but now they're predictable. Tonight, if he hits one in the first inning, will you continue to watch the game? Of course not! He's going to go homerless in his next 16 at-bats, so he definitely won't hit another one out of the park tonight. You'll only regain interest 17 at-bats from now, which is days away. Imagine the massive changes in TV ratings, attendance at games, and advertisement revenue if home runs in baseball somehow switched from a variable-ratio schedule to a fixed-ratio schedule—not because the number of home runs would decrease, but because their predictability would increase.

Thank goodness, such a switch is entirely unrealistic. The excitement of sports (and many other activities) lies not just in the thrill of the next big moment but in the fact that you never know when that thrill might come.

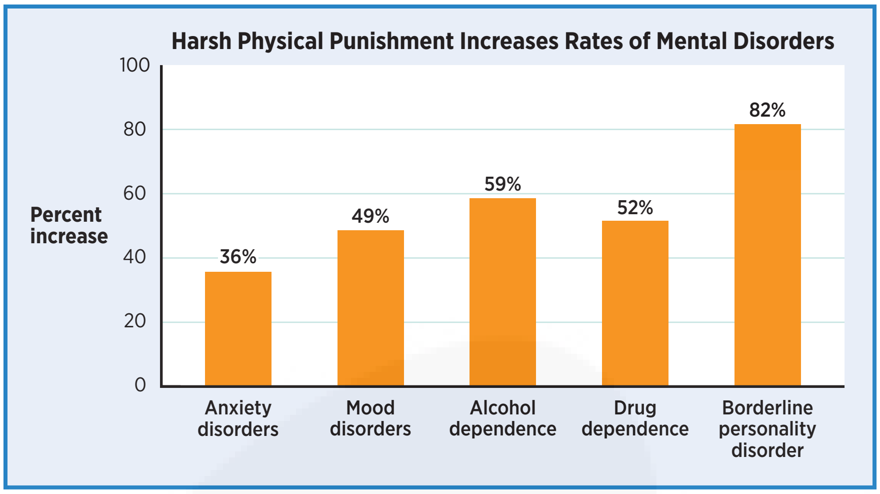


FIGURE 6.6 Harsh Physical Punishment Increases Rates of Mental Disorders Adults who experienced harsh physical punishment as children are at significantly greater risk for many mental disorders than adults who did not. They have an approximately 36% greater chance of anxiety disorders, 49% greater chance of mood disorders, and an 82% greater chance of borderline personality disorder. Data from Afifi et al., 2012

it includes pushing, shoving, grabbing, and slapping. Spanking is not associated with such negative effects on children, especially when parents use it in moderation and only after other punishments, like time-outs, have failed [Ferguson, 2013; Larzelere & Kuhn, 2005; Oas, 2010].)

The message accompanying the punishment must be very clear. Otherwise, there can be confusion about which behavior brought it on (Wacker et al., 2009; Johnston, 1972). For example, consider a teenager who spends an evening on his family's home computer checking social media, watching YouTube videos, listening to music, and shopping for clothes. He then gets grounded by his parents "for what you did on the computer last night." Would he know exactly how to change his behavior? Perhaps it was one particular online activity, or just a couple of them, or the total amount of time he spent doing all of them. His parents' vague explanation does not offer enough information for him to determine specifically what he did wrong.

For all of these reasons, experts in operant conditioning tend to recommend the use of reinforcement of wanted behaviors over punishment of unwanted behaviors. For example, reinforcement has been successfully applied to increase desired behaviors in children with autism (Kern & Kokina, 2008), as well as corporate workers' compliance with computer security procedures (Villamarin-Salomon & Brustoloni, 2010).

Effective Use of Punishment. Punishment can certainly be effective if used wisely. For example, when punishing a behavior, recommend a better behavior, and then strongly reinforce the better behavior when it occurs (Mayhew & Harris, 1979; Murphey et al., 1979; Petscher et al., 2009; Hanley et al., 2005). Make sure the punishment happens immediately after the bad behavior, and explain specifically what the punishment is for (Tanimoto et al., 2004; Walters & Demkow, 1963). This increases the odds that the individual will make the right connection between the behavior and the consequence. If you threatened a punishment, make sure you deliver it as promised, or the individual learns that the threats are meaningless.

Finally, punish the same bad behavior consistently each time it happens. For example, consider the parent who takes away the child's handheld video game system as a punishment for cursing. If the parent does so within seconds of the offensive word; explains, "This is for cursing"; suggests "Say 'darn' instead"; and handles future incidents similarly, the punishment is likely to be effective. If the parent waits hours or days to take away the video game system, offers no explanation why it is happening,

CHAPTER APP 6.3

Punishment

StickK

Preview one of the links and consider the following questions.

WEBSITE:
http://tiny.cc/uch7jy

ANDROID:
http://tiny.cc/sjgyiy

IPHONE:
http://tiny.cc/ljgyiy

VIDEO DEMO:
http://tiny.cc/chapterapps

The app stickK helps individuals change their own behavior, and it relies on punishment rather than reinforcement. Specifically, stickK allows you to set a behavioral goal—exercising 4 times a week, losing 10 pounds, studying 2 hours a day, etc.—and then "bet" your own money that you will succeed. You can specify where the money goes if you fail, including an "anti-charity" (a cause that you personally oppose) of your choosing. This arrangement increases your commitment to complete your chosen behavior so you can avoid the punishment of contributing to a political party, a social movement, or some other organization that disgusts you.

How does it APPly to your daily life?
Consider what you've learned about *punishment*. If you used an app like stickK, would the threat of punishment motivate you to change your behavior? How would the specifics of the punishment (how much money, who receives it, etc.) influence the power of the punishment? stickK also has a searchable list of users, including their behavioral goals and their track record of success and failure. For you, how would the punishment of people knowing you failed compare to the punishment of losing money?

How does it APPly to your understanding of psychology?
Unlike many apps (like ChoreMonster) that utilize reinforcement to change behavior, stickK utilizes *punishment*. Which strategy would you expect to be more effective? Why? What do your answers tell you about the difference between the concepts of reinforcement and punishment? What do your answers tell you more generally about wise use of *operant conditioning?*

This Krispy Kreme *Hot Doughnuts Now* sign is a discriminative stimulus, letting doughnut lovers know that a new batch is fresh out of the oven. © Allen Creative/Steve Allen/Alamy

provides no suggestions for better behavior, and later ignores similar cursing, the punishment is likely to be ineffective.

When used the right way, punishment can even have a vicarious effect. In other words, effective punishment often decreases the unwanted behavior not only in the person receiving the punishment but in other people who observe the punishment too (Malouff et al., 2009). Consider the child from the previous paragraph who got his handheld video game system taken away because he used bad language. If his sister sees how he got punished, she's less likely to use bad language herself.

Discriminative Stimuli

One of the problems associated with punishment is that individuals may learn to change their behavior only in the specific situations when they know they'll get caught. The ability to identify these specific situations hinges on the presence of a **discriminative stimulus**: a signal that indicates that a particular behavior will be followed by a particular consequence. Discriminative stimuli are important not only to punishment but to any kind of learning.

Recognizing a discriminative stimulus allows us to act when the chances of obtaining reinforcement are greatest and the chances of getting punished are least. For example, Jeff is a professional drummer who lives in a small apartment building with a policy against loud noise. The landlord has fined Jeff for drumming in the past, but Jeff has learned to look in the parking lot for the landlord's yellow Ford Mustang. If it is there, he doesn't drum for fear of the fine. If it's gone, he pounds away. That Mustang serves as a discriminative stimulus for Jeff. Its presence signals that drumming brings financial loss, but its absence signals that the same behavior brings enjoyment.

Discriminative stimuli need not be visual, as in Jeff's case. Animals and people can also learn that certain sounds, smells, tastes, and touches signal certain kinds of feedback. For example, you know you'll get a new text message if you check your phone right after you feel it vibrate in your pocket. One fascinating experimental study found that rats could learn to use music as discriminative stimuli. First, they placed rats in a Skinner box and provided food whenever the rats pressed a lever. Then, they added a new rule. Lever pressing brought about food when the Beatles'"Yesterday" was playing but not when Mozart's *Die Zauberflöt* was playing. Sure enough, with enough experience, the rats became music connoisseurs and pressed the lever when they heard the Beatles but not Mozart (Okaichi & Okaichi, 2001).

Shaping

Sometimes, the behavior to be learned isn't as simple as pressing a lever or pecking at a button. In these cases, the behavior isn't learned all at once, but *shaped*, little by little (Skinner, 1938, 1974; Krueger & Dayan, 2009.). **Shaping** is the process of gradually learning a complex behavior through the reinforcement of each of its small steps. Animal trainers are experts in shaping, especially those who work in a circus or zoo where the animals perform. For example, if the trick calls for a dolphin to circle the pool and then jump out of the water through a hoop, the trainer begins by reinforcing the first step in that behavior—say, swimming halfway around the pool. Then the trainer ups the ante, offering reinforcement only when dolphin circles three-quarters of the pool, then the whole pool. Next, to earn the reinforcement the dolphin must peek its beak out of the water after circling the pool, then its fins, then its whole body, then touch the hoop, then go through the hoop. Through the reinforcement of each baby step, the dolphin learns to do the full trick.

LIFE HACK 6.1

When you use punishment to change someone else's behavior, provide a specific suggestion for a better behavior they can do instead.

(Mayhew & Harris, 1979; Murphey et al., 1979; Petscher et al., 2009; Hanley et al., 2005)

Does shaping happen with people as well as animals?

Yes, human behavior is often shaped as well. Consider DeAndre, a youth basketball coach trying to teach his first-grade player, Derrick, to shoot a layup. A layup may look easy, but it's actually a complex behavior, particularly for a young child. Consider the parts: jump off the proper foot, shoot with the correct hand, and bounce the ball off the backboard. If DeAndre's plan is to wait for Derrick to spontaneously shoot a perfect layup and then reinforce him for it, he may be waiting forever. Derrick may never do it on his own. Instead, DeAndre teaches the first part in isolation—jumping off the proper foot as he approaches the basket. Every time Derrick gets it right, he gets a heartfelt "Good job!" from his coach. After some repetition and success with the feet, DeAndre adds the next step, shooting with the correct hand, praising Derrick only when he does both well. Once Derrick masters this, DeAndre shows Derrick the spot to hit on the backboard and praises him only when he puts it all together—good foot, good hand, and good backboard. (The swish of the net doesn't hurt either—it's a bonus reinforcement when Derrick does every part of the layup right!)

To get an animal (or a person) to learn a complex behavior, it is most effective to use shaping, or reinforcing each of the small steps of the behavior. Konstantin Kirillov/iStock/Getty Images Plus

Operant Conditioning Versions of Some Classical Conditioning Concepts

Many of the terms we introduced earlier in this chapter under the classical conditioning heading apply to operant conditioning too. For example, ***generalization*** and ***discrimination*** happen in operant conditioning. Let's consider Derrick, the first-grade basketball player, one more time. When he receives praise for successfully performing the layup and all of its parts, he's receiving it from a particular coach in a particular gym. Let's imagine that Derrick's next opportunity for a layup takes place in a different gym and with a different coach. Would Derrick expect to receive similar praise in this new setting? To the extent he does, he's generalizing what he learned from DeAndre. To the extent he doesn't, he's discriminating between the original situation and the new one.

Acquisition and *extinction* are also important concepts in operant conditioning. In this context, acquisition refers to the point when the learner makes the connection between a particular behavior and its consequence. Extinction refers to the point when the learner realizes that that connection no longer applies. Remember our discussion of the operant conditioning involved with soda machines? Acquisition occurs when we learn that "If I insert money and press a button, then I get soda." Extinction occurs when we later learn—from a broken soda machine—that "If I insert money and press a button, then I *don't* get a soda."

When extinction occurs in operant conditioning, it follows a predictable pattern—the behavior actually *increases* first and dies out later, as shown in **Figure 6.7**. Psychologists call the first part of this pattern, when the behavior gets more intense or

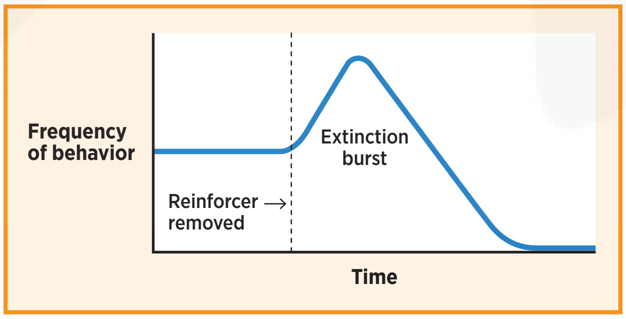
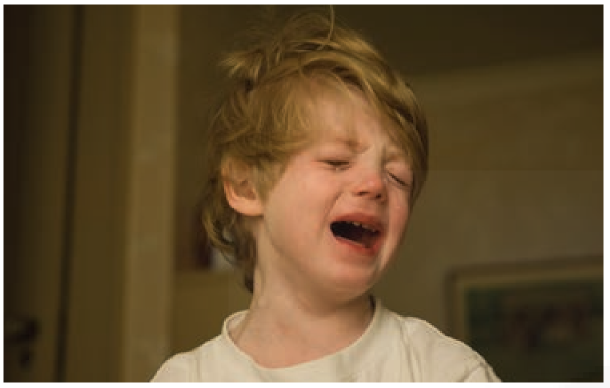


FIGURE 6.7 **Extinction** Here's how extinction works: When you've learned that a behavior that used to bring you reinforcement no longer brings any reinforcement, you'll eventually decrease that behavior. However, before that decrease starts, your first reaction will be an *increase* in the frequency or intensity of the behavior—that increase is the extinction burst. As long as that increase doesn't result in the return of the reinforcement, extinction will follow.

discriminative stimulus
A signal indicating that a particular behavior will be followed by a particular consequence.

shaping
The process of gradually learning a complex behavior through the reinforcement of each small step that is a part of the complex behavior.



Sometimes you're in control of the reinforcement that another person gets. If so, you have the power to influence his or her future behavior. If you were caring for this child, your response to the tantrum would influence whether the child decided to throw another tantrum the next time a similar situation came up. Joel Sartore/National Geographic/Getty Images

frequent, an *extinction burst*. Picture yourself at that broken soda machine. When you insert the money, press the button, and get nothing, you press the button again and again, try the other buttons, and even shake the machine. Only after all of these efforts fail do your efforts to get a soda extinguish.

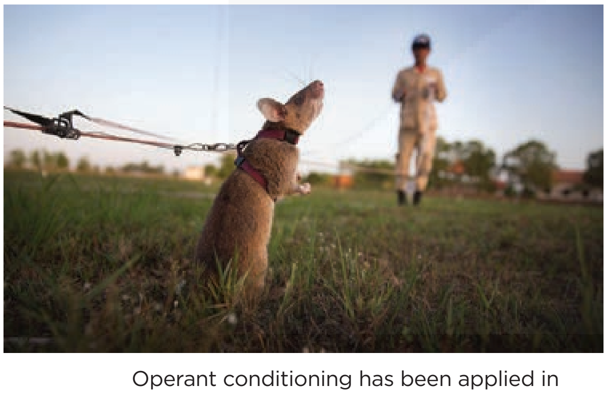
Imagine for a minute that intensifying your behavior made the soda come out. You would learn that when you don't get the reinforcer you expect, you should just try harder and you'll get it. This is a powerful lesson to keep in mind when you *are* the soda machine—that is, when you are the source of reinforcement for someone else. For example, let's say you have a regular babysitting gig for a 6-year-old boy. He has learned from experience that if he says, "I'm not tired," after you tuck him in, you let him get out of bed and watch TV. If his parents instruct you to be stricter, what should you expect the boy to do the first time you don't let him watch TV? He certainly won't go down without a fight. He'll ask repeatedly, scream, cry, throw a fit—anything he can think of to get his reinforcer (watching TV). If you stand firm, he'll eventually give up, having learned that there's a new rule in place. If you give in, however, he'll simply learn that he has to redouble his efforts to get what he wants, and that's what he'll do in the future.

Applying Operant Conditioning to Your Life

Anywhere you find a person receiving a consequence for an action, operant conditioning is at work. Many psychologists use operant conditioning to help people reduce unwanted behaviors. (This approach, known as *contingency management*, is discussed in more detail in the therapy chapter.) The logic goes like this: the client is behaving a certain way because of the consequences that follow the behavior, so if the consequences change, then the behavior will change too (Drossel et al., 2008; Kearney & Vecchio, 2002; Villamar et al., 2008).

For example, consider Braden, a 7-year-old boy who refuses to go to school. When his parents try to get him out of bed in the morning, he screams, "I don't want to go!" and pulls the covers over his head. His mother responds to Braden's screams by cuddling with him in his bed for 30 minutes, while his father brings him breakfast in bed. Whether they realize it or not, Braden's parents' behaviors are positive reinforcement for Braden's school refusal behavior. The family's psychologist, Dr. Abrams, suggests that they stop providing such reinforcers and possibly replace them with reasonable punishments (like losing TV time) when Braden refuses to go to school. Dr. Abrams also suggests that Braden's parents shape Braden's behavior by reinforcing small steps in the right direction, like getting out of bed, getting dressed, getting his backpack on, and so on. After a short adjustment period, Braden learns the new consequences and his behavior changes—refusing school far less often and attending school far more often.

Operant conditioning also forms the basis of our legal system. Our laws are really no more than a long list of contingencies: if you commit this crime, you get this punishment. Of course, one of the larger goals of such a list of contingencies is to protect people who might otherwise be victims of theft, rape, murder, or other harmful acts. Many states are grappling with how to punish a relatively new behavior with the potential to cause great harm to others: texting while driving (Ibrahim et al., 2011). Although college students strongly agree that texting while driving is unsafe, an alarming percentage (91%) have done it (Harrison, 2011). In some states, texting while driving is a criminal offense punishable by a fine up to $2500 and up to 12 months in jail (Walker, 2012). In other states, the punishment is a mere $20 infraction (Gershowitz, 2012).



Operant conditioning has been applied in many creative ways. For example, animal trainers have used operant conditioning to teach giant African rats to respond in a particular way to the scent of TNT, an explosive found in landmines. By doing so, they help people locate them so they can be deactivated or removed. Taylor Weidman/Getty Images

Sometimes, operant conditioning can affect human lives even though it's not humans who are being conditioned. For example, dogs can be trained through operant conditioning to help people with a variety of physical disabilities, such as impairments of sight, hearing, or mobility. The dog's training consists of reinforcements and punishments for particular behaviors that correspond with the needs of the person with a disability. For example, trainers reward these dogs for heeling (staying alongside the leg or wheelchair of their owner) through the use of reinforcements. Similar training underlies bomb-sniffing and drug-sniffing dogs, which are reinforced for barking or otherwise notifying their owners when they smell a particular scent.

Researchers have even trained giant African rats to find landmines! The rats' excellent sense of smell helps them to pick up the scent of TNT, the explosive used in most landmines. The researchers reinforce the rats by offering food when the rats hold their noses over a landmine for a five-second period. The rats are then motivated to scurry across a field and pause over any landmines they find, allowing their owners to deactivate or remove them. This is a vital application of operant conditioning, especially considering that landmines are found in over 70 countries and cause a great deal of injury and death (Poling et al., 2010, 2011).

CHECK YOUR LEARNING:

6.11 What is operant conditioning?

6.12 How does operant conditioning relate to the law of effect?

6.13 Who is B. F. Skinner, and why was his research on operant conditioning important?

6.14 How do psychologists define reinforcement?

6.15 What are the differences between the positive and negative reinforcement?

6.16 What are the differences between these pairs of schedules of reinforcement: continuous versus partial; fixed-ratio versus variable-ratio; and fixed-interval versus variable-interval?

6.17 How do psychologists define punishment?

6.18 What role do discriminative stimuli play in operant conditioning?

6.19 With regard to operant conditioning, what is shaping?

6.20 Which classical conditioning concepts also occur in operant conditioning?

Observational Learning

YOU WILL LEARN:

6.21 what observational learning is.

6.22 how Albert Bandura studied observational learning.

6.23 the relationship between observational learning and brain cells called mirror neurons.

So far, our discussion of learning in this chapter has focused on the individual's direct experiences—in other words, how you learn from what happens to *you*. But the truth is that you also learn a lot from what you see happening to other people. We call this **observational learning**: learning that occurs as a result of observing others' behavior and consequences rather than your own. For example, if your close friend has a frustrating experience with her new phone—short battery life, dropped calls, and so on—you'll avoid that model when it's time for you to get a new one. If your older brother has a great experience working for a particular company—he's treated fairly, paid well, and so on—you'll apply there as well. Other people's experience counts for you as well.

The Bobo Doll Studies

A classic series of studies by Albert Bandura and his colleagues, known as the Bobo doll studies, illustrates the power of observational learning (Bandura et al., 1961, 1963). Here's the scene: a preschool-aged child playing with toys watches an adult (the *model*) interact with a Bobo doll, a large standup inflatable punching bag figure with a clown painted on it. Half of the children saw the model ignore the Bobo doll; the other half saw the model be physically aggressive toward it. The aggressive models kicked the doll, yelled at it, punched it, and hit it with a hammer. All of the children then had their own toys unexpectedly taken away in an attempt to frustrate them and were placed alone in the room with the Bobo doll. How did the children deal with their frustration? It depended on what they had observed in the model. The children who saw the model act

observational learning
A type of learning that occurs as a result of observing others' behavior and consequences rather than our own.

CURRENT CONTROVERSY

Does Violence in the Media Cause Violence in Real Life?

Very few topics in psychology have created as much public controversy as the impact of violence in the media (Kirsh, 2012; Huesmann, 2010; Ferguson & Kilburn, 2010). We are certainly exposed to a lot of media violence:

- Of video games rated T (for Teen), 98% involve intentional violence, 90% reinforce the player for causing injury, and 69% reinforce the player for killing (Haninger & Thompson, 2004).
- On U.S. TV, 61% of shows contain acts of violence, and 54% contain lethal violence. In shows containing violence, 45% of the offenders went unpunished (Federman, 1998).
- Between 1998 and 2006, the amount of violence in PG-13 movies—which children can see without a parent—increased so dramatically that a researcher who conducted the study said that "today's PG-13 movie was yesterday's R movie" (Leone & Barowski, 2011; Leone quoted in "http://www.newswise.com/articles/new-research-reveals-pg-13-movies-are-becoming-more-violent").
- By the age of 12, U.S. kids spend more time in front of screens (TV, movies, computers, video games, and so on) than they do at school (Bushman & Huesmann, 2010).

Hundreds of studies have been conducted to explore the effects of media violence, with widely mixed results (Bushman & Anderson, 2001). Even *meta-analyses*, which statistically combine the results of many studies, come to very different conclusions. Most find that media violence has a definitive link to violent behavior (Anderson et al., 2010; Anderson & Bushman, 2001). Other meta-analyses find just as definitively that no such link exists between media violence and violent behavior (Ferguson & Kilburn, 2009).

One of the significant challenges in determining the impact of media violence is figuring out how to study it (Ferguson & Savage, 2012). Some researchers have used an *experimental* method, in which they manipulate people's exposure to media violence and then observe their reactions, all within a single session. One study, for example, used a procedure very much like Albert Bandura's classic Bobo doll study, but with a more contemporary twist (Shutte et al., 1988). The researchers had children age 5 to 7 play either a violent or nonviolent video game and then gave them free time in a play room. Kids who played violent video games were more likely than kids who played nonviolent video games to hit and kick—not only the large doll in the room but the other kids in the room as well. In another study, participants played either a violent or nonviolent video game and then watched a video of real-life violence. For the participants who played a nonviolent video game, heart rates went up when they watched the real-life violence. However, for the participants who played a violent video game, heart rates actually went down, suggesting that the video game violence had desensitized them (Carnagey et al., 2007).

Other researchers have taken a *longitudinal* approach to studying the impact of media violence. They followed participants over a period of years, rather than testing them in just one sitting, to see how video game violence affected them. One group of researchers studied teens over a three-year period and found that those who played violent video games more often were no more likely to behave aggressively than those who played them less often. Other variables, such as violence in their family home and the extent to which they were depressed, were much better predictors of aggressive behavior (Ferguson et al., 2012). Another longitudinal study tracked participants for a much longer time, from childhood into young adulthood. It found that those who watched more violent TV when they were 6 to 10 years old were more likely to behave violently 15 years later (Huesmann et al., 2003).

With regard to the studies that do find that media violence and violent behavior go together, it is important to remember from Chapter 1 that a correlation does not necessarily mean cause. In other words, if media violence and violent behavior go together, it could be true that media violence causes violent behavior. Or it could be true that other factors—perhaps parenting styles, poverty, or cultural norms—cause people to prefer violent media and to behave violently. It could even be true that a life involving lots of real-world violence influences people to seek out violent TV, movies, and video games. ⬢

aggressively toward the Bobo doll were more likely to act aggressively themselves than the children who saw the model ignore the Bobo doll. They kicked it, yelled at it, punched it, and hit it with a hammer—just as they had seen the model do moments earlier.

Did the models in those studies get anything—a reinforcement or a punishment—after they acted aggressively toward the Bobo doll?

In these early Bobo doll studies, the model's aggressive behavior did not bring about any consequences. But what if it did? What if the children saw the model receive either reinforcement or punishment after beating up the Bobo doll? Would *vicarious learning* take place? Bandura examined this question and found that the observed consequences do make a difference: children who saw the model get rewarded for aggressive behavior acted more aggressively themselves than did children who saw the model get punished. However, Bandura then offered sticker booklets and juice to the children who saw the model get punished—but only if they

The classic Bobo doll studies by Albert Bandura illustrated that the way kids interact with a doll was strongly influenced by what they learned when they observed adults interacting with the same doll. In each of these pairs of photos, the upper photo shows an adult doing something to the Bobo doll and the lower photo shows a child doing the same thing. Courtesy of Albert Bandura

repeated the aggressive behavior that they saw the model get punished for. They had no problem doing so. This suggests that these children had added the model's aggressive behavior to their own behavioral repertoire even if they had chosen not to display it at first (Bandura, 1965).

The Bobo doll studies demonstrate the often-overlooked power of *modeling*, or imitation of observed behavior. The behavior we watch can strongly influence the behavior we exhibit. And we watch a lot, not only in person but on screens of various kinds: TV, movies, YouTube, video games, and so on. For instance, exposure of children to movies depicting smoking has been shown to significantly predict established smoking patterns when the children reach their late teens (Dalton et al., 2009; Heatherton & Sargent, 2009). In addition, an alarming amount of what we watch in these various media forms is violent, and violent crime statistics are equally alarming. Does the observation of violence in the media contribute to violent behavior? The Current Controversies box examines this issue in detail.

It is important to consider observational learning not only from the perspective of the learner, but from the perspective of the model as well. What behaviors do you model, and who's watching? If you are a parent (or an aunt, uncle, or older sibling, say), this is a particularly relevant question. You may not identify yourself as a model for the children around you, and you may not have invited them to follow your lead, but they are likely to do so anyway. For example, parents who overeat are more likely to have children who overeat; parents who smoke are more likely to have children who will smoke; and parents who use verbal or physical aggression are more likely to have children who do so (Francis et al., 2007; Gilman et al., 2009; Pagani et al., 2004, 2009).

On the other hand, parents who read are more likely to have children who read; parents who do charity work are more likely to have children who do charity work; and parents who eat healthy are more likely to have children who eat healthy (Bus et al., 1995; Bekkers, 2007; Anzman et al., 2010; Skibbe et al., 2008). Simply put, observational learning can lead to behavior that is good or bad, productive or wasteful, prosocial or antisocial. Note that it's not the parents' instruction that we're talking about but the parents' behavior. (It's not parents who tell their kids to read but parents who actually read who are most likely to have kids who read.) Of course, parents' instructions are powerful messages too, but often not as powerful as the example they set.

The power of modeling, or the imitation of observed behavior, is important to keep in mind especially when you are the model. Kids tend to follow their parents' lead with both desirable and undesirable behaviors.
(a)Peter Cade/The Image Bank/Getty Images (b) Tetra Images/Getty Images

LIFE HACK 6.2

Remember the Bobo doll studies when kids are around. Kids are learning and making decisions about their own behavior by observing your behavior and the consequences it brings.

(Bandura et al., 1961, 1963; Francis et al., 2007; Gilman et al., 2009; Pagani et al., 2004, 2009)

From the series of studies he conducted, Bandura (1986) identified four particular abilities that must be present in the observer in order to learn from a model: *attention*, *memory*, *imitation*, and *motivation*. Absence of any one of these four abilities in the observer will prohibit observational learning no matter what the model does. For example, consider Danielle, a 3-year-old whose mother knits. Will Danielle learn to knit? First, Danielle will have to pay attention to her mother's knitting behavior. If she's asleep when it happens or is always watching TV instead, she may not pick up on it. Second, Danielle will have to remember what she needed to imitate the behavior—what materials are necessary to knit, where they are, and so on Third, Danielle will require the ability to imitate the behavior. As a three-year old, she may lack the dexterity or the patience that she sees in her mother. Fourth, Danielle will have to be motivated to knit. This is most likely to happen if she sees her mother experience rewards from knitting, either by her mother showing pride in her work or from others rewarding her with money or praise.

Mirror Neurons

In recent years, researchers who focus on the biology of the brain have discovered particular cells that relate directly to observational learning. These brain cells, known as **mirror neurons**, are thought to underlie empathy and imitation and activate when a person performs *or* observes a particular behavior (**Figure 6.8**). The key phrase in that definition is *performs or observes*. In other words, the same neuron in your brain fires whether you perform the behavior yourself or watch someone else do it. If a bowling ball drops on your toe, you cringe. If you see a bowling ball fall on the toe of a stranger a few lanes away, you cringe too. Of course, you don't feel his pain to the same extent that he does, but you feel it a little bit, thanks to your mirror neurons (Iacoboni, 2009; Rizzolatti & Craighero, 2004; Heyes, 2010).

Mirror neurons were actually discovered in monkeys, and our understanding of them in monkey brains is far more advanced than our understanding of them in

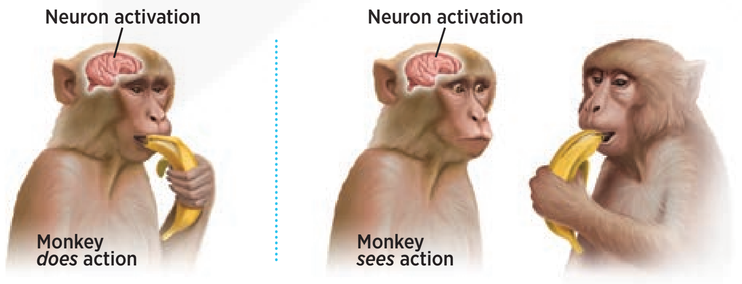


FIGURE 6.8 Mirror Neurons in the Brain The discovery of mirror neurons revealed that behavior causes very similar activation of neurons whether you perform the behavior yourself or watch the behavior performed by someone else. Mirror neurons are a relatively recent discovery, but researchers believe that they may play a significant role in observational learning, empathy, and imitation.

human brains (Fabbri-Destro & Rizzolatti, 2008). In these studies, wires are connected directly to the motor cortex in the frontal lobe of monkeys. This allows researchers to identify particular mirror neurons that fire in monkey A when it sees monkey B perform particular behaviors, such as breaking a peanut shell open or grasping a ball. Researchers have identified mirror neurons and located them within the brain, but they still have a lot left to learn. However, researchers are closer to understanding the biological mechanism by which what we observe becomes what we do. Perhaps the old saying, "Monkey see, monkey do," skipped a step. "Monkey see, monkey mirror neurons fire, monkey do" is less catchy but probably more accurate.

mirror neurons
Neurons that are thought to underlie empathy and imitation and that activate when a person performs or observes a particular behavior.

biological preparedness
An animal's evolutionary predisposition to learn that which is most relevant to the survival of that species.

CHECK YOUR LEARNING:

6.21 What is observational learning?

6.22 Who conducted the Bobo doll studies, and what concept did those studies most clearly demonstrate?

6.23 What role do mirror neurons play in observational learning?

Biological Influences on Learning

YOU WILL LEARN:

6.24 what biological preparedness is and how it affects learning.

6.25 how John Garcia and others have studied biological preparedness.

6.26 how learning can be limited by instinctive drift.

The impressive findings of Pavlov, Skinner, and others during the early days of learning research led some experts to believe that any animal could be conditioned to learn any behavior (Kimble, 1981). At the time, researchers assumed that animals (and people too) enter the world as blank slates, available to be conditioned (classical or operant conditioning) by any life experience that they might encounter. It turns out to not be entirely true. We actually enter the world with an inborn head start toward certain learning experiences—especially those that increase the chances that we will stay healthy and safe. (Seligman, 1970; Seligman & Hager, 1972; Logue, 1979). The word psychologists use to describe this head start is **biological preparedness**: an animal's evolutionary predisposition to learn what is most relevant to the survival of that species. It's as if we have been primed by our ancestors to have *almost* learned certain connections before we have any experience at all. Then, just a little conditioning is enough to complete the connection.

Taste Aversion

Consider how easy it is to learn a connection between what you eat and how your stomach feels. Remember the last time you had food poisoning? There's a good chance you developed an immediate strong dislike, or *taste aversion*, to what you ate (say, blueberry yogurt) before you got sick. But there's a poor chance that you developed an immediate strong dislike to what you saw (the tables and chairs, the people you were with) or what you heard (the topic of conversation, the music) as you were eating. You were much more likely to learn that the blueberry yogurt made you sick (rather than the sights and sounds in the room). The reason is that evolution primed—or biologically prepared—you to do so. Your ancestors had a predisposition toward making this taste–sickness connection. Just as they passed on other survival-of-the-fittest characteristics, they passed that predisposition to future generations, including you.

John Garcia and his colleagues conducted classic studies with rats that parallel this taste aversion experience. Their research illustrated that certain learning connections are more likely than others because of biological preparedness (e.g., Garcia et al., 1966,

When doctors know that chemotherapy will cause nausea, they will often give patients a very unusual food—perhaps cucumber popsicles—as a scapegoat food. The intention is to allow patients to develop a taste aversion to something they may never eat again rather than a food they commonly eat. © Larissa Veronesi/Westend61/Agefotostock

1989). They began by giving rats either "sweet water" (water with a sugary substance mixed in) or "bright noisy water" (water that tasted plain but was accompanied by a bright light and a loud sound). Soon after drinking, the rats received one of two consequences: nausea (caused by radiation), or mildly painful electric shock. Rats who drank the sweet water and then experienced nausea avoided the sweet water when it was offered again. However, rats who drank the sweet water and then received an electric shock didn't hesitate to drink the sweet water when it was offered again. It seems they were predisposed to link the water's sweet taste to nausea but not to physical pain.

On the other hand, rats that drank the bright noisy water and then experienced nausea were eager to drink bright noisy water again, but rats who drank the bright noisy water and then experienced electric shock avoided bright noisy water from that point on. They were more likely to connect sights and sounds to physical pain than to nausea (Garcia & Koelling, 1966). Both of these findings are consistent with the evolution of rats (and most other animals). In other words, Garcia's rats seem to have been born, thanks to their genetic inheritance, with a head start toward connecting food with nausea and sights or sounds with physical pain, which would enhance their ability to survive in the wild.

Garcia and other researchers have put their research on taste aversion to practical use (Garcia & Gustavson, 1997; Gustavson et al., 1974, 1976). The real-world problem was that sheep farmers were losing large parts of their flocks to nearby packs of wolves. To stop the wolves from attacking the sheep, the researchers offered the wolves a sheep carcass tainted with a substance that made them very ill. Of course, the wolves devoured the carcass, but they developed a taste aversion to sheep in the process. They very quickly stopped preying on the sheep at all, to the farmers' delight. Similar taste aversion strategies have also been applied to keep raccoons from preying on chickens and to keep blackbirds from plundering sunflower crops (Nicolaus et al., 1982; Gustavson et al., 1982).

For another real-world illustration of the biological preparedness that underlies the learning of food aversions, consider cancer patients going through chemotherapy. Chemotherapy causes nausea, among other side effects. Many patients develop an aversion to food they ate immediately before chemotherapy treatments. They may realize intellectually that the treatment caused the nausea, but the biological predisposition to link food rather than other stimuli with stomach problems is so strong that it's hard *not* to make the connection (Bernstein, 1978; Bernstein & Webster, 1985; Hong et al., 2009). Fortunately, physicians have developed a technique to make sure that chemotherapy patients don't develop aversions to their favorite foods: they give patients a "scapegoat food"—often an unusual kind of ice cream, candy, or fruit juice that the patients have never had before—with the intention that the patient will develop an aversion to that new food instead of an old favorite (Scalera & Bavieri, 2008; Broberg & Bernstein, 1987; Bernstein, 1999).

Are food aversions the only way biology influences learning?

Food aversions are not the only evidence of biological preparedness. Consider phobias (see Chapter 14), especially the things people are most commonly afraid of: spiders, snakes, heights, enclosed spaces, the dark, dogs, and other animals. We remain quick to learn to fear these objects because evolution has biologically predisposed us to do so. For thousands of years they were life-threatening, and we inherited the same readiness to steer clear of them that kept our ancestors alive and well. The fact that these things and situations aren't usually life-threatening anymore or that other things and situations have taken their place in the most recent generations, hasn't had time to register in our collective DNA, so we remain very likely to develop these highly unnecessary phobias. Even though objects like guns, knives, and speeding cars are much greater threats in our modern lives, phobias to these objects are rare (Cook et al., 1986; Gerdes et al., 2009; McNally, 1987; Gamble et al., 2010; Scher et al., 2006; Seligman, 1971).

The most common phobias involve objects that no longer pose threats to our daily lives, like spiders, snakes, and heights. The fact that humans are still predisposed to develop these specific phobias, rather than phobias toward things that actually pose greater contemporary danger, illustrates the biological (and evolutionary) influence on learning. Cathy Keifer/Shutterstock

Instinctive Drift

As a final example of the influence of biology on learning, consider **instinctive drift**: the tendency of animals' behavior to return to innate, genetically programmed patterns. If you offer an animal reinforcement in a way that is inconsistent with its instinct, the reinforcement may work temporarily, but the animal gravitates back toward the behaviors that come naturally. In a classic paper, two former students of Skinner, who had gone on to become animal trainers in a zoo, describe how they were occasionally unable to train animals to perform the desired behavior (Breland & Breland, 1961). The problems always involved the animals doing what instinct rather than reinforcement told them to do. For example, when the trainers tried to teach a raccoon to pick up coins and drop them into a piggy bank, the raccoon couldn't stop rubbing the coins together and dipping them in and out of the piggy bank rather than simply dropping them in—just as the raccoons would with food before eating. Similarly, when they tried to train pigs to do the same drop-the-coin-in-the-bank trick, the pigs too often rooted the coins—that is, dropped them and pushed them around on the ground with their snout—as they would naturally in a search for food.

Anyone who has failed to stick to a weight loss program might appreciate the phenomenon of instinctive drift. You receive reinforcement for healthy eating and exercise behaviors—prizes you promise yourself such as new clothes or kind words from others about your new look. But your instinct is to eat fattening foods—thanks to an evolutionary history in which food was rarely as plentiful as it is today. So you may find yourself drifting back to the same unhealthy eating and exercise habits that led to your excess weight in the first place. The lesson here is that any attempt to use operant conditioning to influence the behavior of an animal or person may have to overcome some strong inborn biological tendencies. Instinctive drift suggests that there may be at least a little bit of truth to the old saying that a tiger—or raccoon or pig or person—doesn't change its stripes.

Instinctive drift is the tendency of an animal's behavior to return to innate, genetically programmed patterns. Researchers who tried to train raccoons to drop coins into a slot ran into difficulties because the raccoons couldn't stop rubbing the coins together and dipping them in and out of the slot, as they naturally do with food in water. © tbkmedia.de/Alamy

instinctive drift
The tendency of animals' behavior to return to innate, genetically programmed patterns.

CHECK YOUR LEARNING:

6.24 What is biological preparedness, and how is it relevant to learning?

6.25 How have John Garcia and others studied biological preparedness?

6.26 What is instinctive drift, and how is it relevant to learning?

Cognitive Influences on Learning

The pioneers of learning research overlooked not only the importance of biology but also the importance of cognition—or *thinking*—on learning. Early researchers seemed to believe that we learned mechanically, automatically, without thought—whether associating stimuli in classical conditioning or associating a behavior with its outcome in operant conditioning. If we reconsider a few of the examples from earlier in this chapter, it's easy to see how some kind of cognition actually plays an important role in learning. Remember Jenny, whose Uncle Joe drives a red sports car and takes her out for ice cream? It's not a stretch to imagine that—between Jenny's sight of a red sports car and her feeling of excitement—there's a quick thought about what a red sports car means to her. Remember Zach, whose father, Alex, reinforced him by taking him to his favorite restaurant when he cut the grass? The contingency Zach learns ("If I cut the grass, then I get to go to my favorite restaurant") is actually a thought, an interpretation that explains the connection between his actions and their consequences. Even when

YOU WILL LEARN:

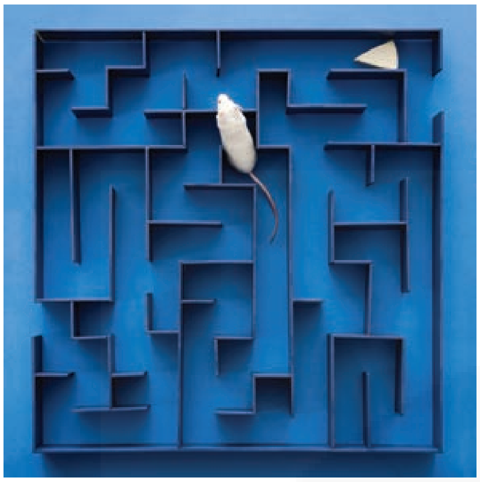
6.27 that cognition, or thought, influences learning.

6.28 how cognitive maps help us learn.

6.29 that what we learn can remain latent until given the chance to emerge.

6.30 that we sometimes use insight to enhance trial-and-error learning.

6.31 that experiences in which we perceive no control over unpleasant events can lead to learned helplessness.



Developing a cognitive map, or mental diagram, of the physical environment can facilitate learning. Specifically, it can be easier to retrieve a reinforcement if you know the lay of the land that you need to travel to get to it. Rubberball/Mike Kemp/Getty Image

we discuss the way animals learn, we use verbs like *associate* and *expect* and *predict*—all of which suggest that there's some kind of cognitive activity going on in their mind that affects the process.

Cognitive Maps

Edward Tolman conducted some important early studies that provide evidence of cognition during learning (Tolman, 1932, 1948; Tolman & Honzik, 1930). Tolman put rat A in a maze and offered it no reinforcement. Rat A explored the various alleys and corners of the maze. Tolman later replaced rat A with rat B and placed food at the exit. With time, rat B eventually learned to make its way through the maze to reach the food. Finally, Tolman removed rat B, put rat A back in the maze, and placed the food at the exit. That's when Tolman observed the key result of this study: rat A reached the food for the first time *much more quickly* than rat B did. It was as if rat A had been taking mental notes about the maze as it wandered around earlier. Rat A seemed to have developed a **cognitive map**—a mental diagram of the physical environment—while it initially explored when no reinforcement was available.

Rat A's cognitive map clearly improved its ability to navigate the maze to reach the food. Comparing the abilities of rat A and rat B to reach the food for the first time is like comparing two people trying to find a newly opened food court in an airport: an out-of-towner in the terminal for the first time (rat B), and a hometowner who knows the terminal like the back of his hand (rat A). Tolman's conclusion was that rat A—and all other rats, animals, and humans—have the ability to use cognition to speed up the learning process.

Rat A seemed to be mentally stockpiling what it had learned as it explored the maze: where the dead ends were, what sequence of rights and lefts led to a particular spot, and so on Only after the food was offered did rat A have the opportunity to demonstrate what it knew. Rat A's quick solving of the maze once food was offered showed evidence that it was engaged in *latent learning* during its initial time in the maze. **Latent learning** is learning that has taken place but cannot be directly observed.

Here's an example that shows both the cognitive map and latent learning: a teenage girl driving a car for the first time. She has never been behind the wheel before, but for more than 15 years she has been a passenger and learned quite a bit—the layout of the local streets, the functions of various controls around the steering wheel, and what the pedals do. When her nervous mother starts the lesson by saying, "Let's just take a short trip to the park," the girl has at least a rough idea what to do: turn the key in the ignition, put the car in drive, move her right foot from the brake to the gas, make a left and then two rights to arrive at the park. Her mother is there to talk her through the details, but thanks to all of the latent learning she has done over the years, the girl learns to drive in a much shorter period of time than another 15-year-old who has never been in a car before. And the cognitive map is there too: she knows to take a left and two rights to get to the park not because she's getting directions from Google Maps, but because she has her own internal GPS from her years driving the neighborhood streets with her mother.

cognitive map
A mental diagram of the physical environment as it is initially explored when no reinforcement is available.

latent learning
A type of learning that has taken place but cannot be directly observed.

insight
The perception of a solution to a problem that results from cognitive understanding rather than from trial and error.

learned helplessness
The absence of any attempt to help oneself that results from previously learning that such attempts are useless.

Insight

Another type of cognitive activity that can influence learning is **insight**: the perception of a solution to a problem that results from cognitive understanding rather than from trial and error. Simply put, sometimes you just plain figure things out because you use your intelligence to deduce the solution. Picture yourself in a crowded coffee shop receiving an important phone call from your doctor. As your doctor is telling you your medical test results, your phone battery runs out. Your charger is lost, and the doctor's office closes in 10 minutes. What to do?

If cognition had nothing to do with learning, you would have no choice but to operate on your environment in a random, hit-and-miss way until one of your actions brings more power to your phone by chance. You might tap your fingers on the café table, or say hi to another customer, or order a grande latte, hoping that one of those behaviors recharges your phone. Of course, you don't do that because you have cognition on your side. You *think* about a solution. After a minute, you remember that the coffee shop is in a strip mall. You exit the coffee shop and discover that right next door is an electronics store that sells your charger. You rush in, buy one, plug in your phone, call back your doctor, and finish your call. That experience of suddenly coming up with a solution is called an *aha moment* (as in, "Aha! I figured it out!"). Neuropsychological studies using fMRI (functional magnetic resonance imaging) show that aha moments rely more heavily on activity in certain parts of the brain, including parts of the frontal lobe like the prefrontal cortex and the anterior cingulate, than other kinds of learning (Aziz-Zadeh et al., 2009; Kounios & Beeman, 2009; Topolinski & Reber, 2010).

In the 1920s in Berlin, Wolfgang Kohler studied chimps who seemed to use their own cognitions to solve problems in a similar way. When Kohler placed a banana outside the chimp's cage, just farther away than its arm could reach, it used a stick inside the cage to pull the banana closer. When Kohler placed another banana a bit farther out, beyond the reach of the first stick, the chimp fastened two sticks together to form a double-length stick, which enabled it to retrieve the banana. When Kohler hung a banana from the ceiling, the chimp stacked crates to form a tower that it could climb to grab the banana. In each of these cases, the chimp's action was preceded by a period of frustration that simpler efforts did not bring about the reward, as well as a period of inactivity in which the chimp appeared to be thinking about the situation. There were also failed attempts at each of the strategies that eventually proved successful (Kohler, 1924; Gould & Gould, 1994). The point is that Kohler's chimps didn't perform random acts and wait for the bananas to land in their laps. The chimps used cognition, or thought, to supplement what they learned from the consequences of their actions.

Latent learning is learning that has taken place but has not yet been demonstrated. For example, a teenager who takes the wheel for the first time may show that she has picked up some knowledge of driving but hasn't had a chance to show it yet.
Shannon Fagan/The Image Bank/Getty Images

Learned Helplessness

A lot of animal research illustrates the influence of cognition on learning, but the studies by Martin Seligman and his colleagues are the most relevant to human suffering and wellness (Overmier & Seligman, 1967; Seligman & Maier, 1967; Seligman, 1975; Overmier & LoLordo, 1998). Seligman used dogs in his studies, and he placed them in an apparatus known as a shuttle box, as shown in **Figure 6.9**. The shuttle boxes were divided into two halves by a short wall (no taller than the dogs' legs) that the dogs could easily jump over. One side of the shuttle box (the shock side) contained an electrified floor through which Seligman could shock the dogs' feet; the other side (the safe side) did not.

In one of their best-known studies (Maier et al., 1969), Seligman and his colleagues divided the dogs into three groups, and each group went through two phases of the study. In the first phase, group 1 received controllable shock: they were placed on the shock side but were free to jump to the safe side, which they quickly learned to do upon the first sign of the shock. Group 2 received uncontrollable shock: they were restrained on the shock side in harnesses that prevented them from crossing to the safe side when shock was delivered. Group 3 received no shock at all.

In the second phase, every dog received controllable shock. As you might expect, group 1 quickly learned to jump to the safe side during the second phase, just as they had in the first. Group 3 also learned to jump to the safe side. But group 2—the dogs who were powerless to do anything to avoid the shock in the first phase—never learned to avoid the shock in the second phase at all. They just stayed there and took it. Sometimes they whimpered and cried, but they never made any effort to alleviate their pain, despite the fact that all they needed to do was make a quick jump over a short nearby wall.

Seligman (1975) later explained that even after he tried to lure the dogs to the safe side—by removing the short wall altogether, by calling to the dogs from the safe side, even by putting salami on the safe side—the dogs did nothing to help themselves. Seligman called the dogs' reaction to this situation **learned helplessness**: the absence of any attempt to help oneself that results from previously learning that such attempts are useless. Seligman explained that the dogs had apparently learned, through their

When you solve a problem by figuring it out rather than by random trial and error, that's insight. Animals show some degree of insight, too. For example, this chimp, which recognized that it could reach the food by stacking the boxes into a kind of ladder (Kohler, 1924; Gould & Gould, 1994).
American Philosophical Society/Science Photo Library/Science Source

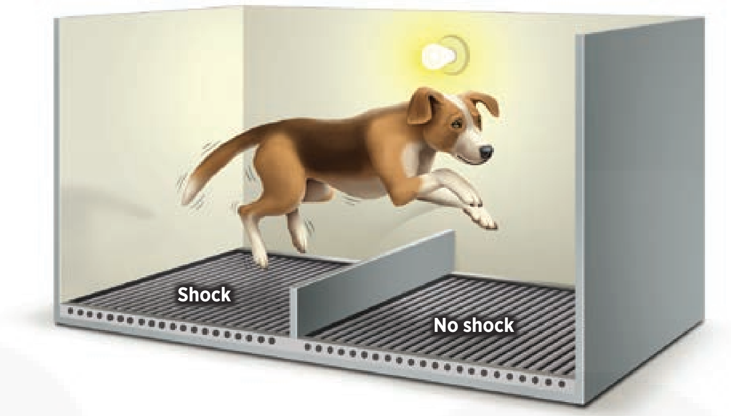


FIGURE 6.9 Learned Helplessness In a series of classic studies, dogs that were free to avoid shock when they saw a warning light learned to do so. But dogs that were prevented from avoiding shock stopped trying, even when they were no longer being prevented. That failure to try to avoid the shock was labeled *learned helplessness*. Some psychologists believe that learned helplessness explains depression in people who have learned that they can't control the negative experiences in their lives (Maier et al., 1969; Seligman, 1975).

experience in the first phase that their pain was entirely outside of their control. This lesson was so strong that even when the situation changed and they could, in fact, exert some control, they didn't realize or accept this fact. In other words, they continued to *believe* they were helpless, and that cognition had a powerful influence on their learning (or lack thereof).

What do these learned helplessness studies with dogs have to do with people?

Seligman and others applied the findings of their learned helplessness studies to human depression. They suggested that people who are depressed resemble the dogs from group 2: they have experienced pain (often emotional rather than physical) that they perceived as uncontrollable. Through that process, they learn they are helpless. As a result, they stop trying to help themselves—despite encouragement from friends and family and even new life circumstances—and resign themselves to endless days of sadness and apathy. As we will discuss in Chapter 14, many factors can contribute to depression, but learned helplessness may be one of those factors for many people.

A final note: later in his career, Seligman shifted his focus to the flip side of learned helplessness, *learned optimism*, in which people can, via their own cognitions, emphasize positive interpretations of life experiences to enhance happiness and ward off depression (Seligman, 1991, 2011). As an example, consider the ways a factory worker can interpret a job layoff. She can blame herself and consider it a permanent setback, which could lead to depression based on the belief that there is nothing she can do to help herself. Or she can blame external circumstances (the company, the economy) rather than herself and consider the layoff a temporary problem. This explanation suggests that things may work out and that she can play an active role in making that happen. Seligman (1991) argues that even if the "helpless" interpretation is the first one that occurs to her, she can train herself to reject it and replace it with the more optimistic way of thinking. This will not only increase the odds that she works to solve her own problem but that she's happy while doing so.

CHECK YOUR LEARNING:

6.27 How much does cognition influence learning?

6.28 What are cognitive maps, and how are they relevant to learning?

6.29 What is latent learning?

6.30 What is insight, and how is it relevant to both cognition and trial-and-error learning?

6.31 What is learned helplessness, and what experiences are likely to produce it?

CHAPTER SUMMARY

What Is Learning?

6.1 Psychologists define learning as the process by which life experience causes change in the behavior or thinking of an organism.

6.2 Learning is the essence of the nurture side of the nature–nurture debate that surrounds all of human behavior. (Maturation is the nature side of the debate.)

6.3 Learning isn't unique to humans. It occurs across all species.

Classical Conditioning

6.4 Ivan Pavlov was a Russian medical researcher studying the digestive system of dogs. Pavlov's accidental discovery of the learning process led to studies that shaped the field of psychology.

6.5 Classical conditioning is a form of learning in which animals or people make a connection between two stimuli that have occurred together, such that one predicts the other. Classical conditioning occurs in everyday life. People have all sorts of conditioned responses to things they see and hear.

6.6 The components of classical conditioning include a neutral stimulus, unconditioned stimulus, unconditioned response, conditioned stimulus, and conditioned response.

6.7 Generalization is the process by which stimuli that are similar to the conditioned stimulus cause the same conditioned response. Discrimination is the process by which stimuli that are different from the conditioned stimulus fail to cause the same conditioned response.

6.8 Acquisition happens when the neutral stimulus becomes a conditioned stimulus by its link to the conditioned response. Extinction happens when the conditioned stimulus no longer causes the conditioned response because it is no longer linked to the unconditioned stimulus.

6.9 Higher-order conditioning is a learning process in which a conditioned stimulus from a previous learning process serves as an unconditioned stimulus, producing a new conditioned stimulus that causes the same conditioned response.

6.10 Vicarious conditioning is conditioning that takes place by way of observation of others' life experiences rather than one's own.

Operant Conditioning

6.11 Operant conditioning is a form of learning in which the consequences of a voluntary behavior affect the likelihood that the behavior will recur.

6.12 The law of effect suggests that the likelihood of repeating a behavior depends on the effects of that behavior.

6.13 B. F. Skinner was a U.S. psychologist who conducted extensive operant conditioning studies on animal behavior. Skinner's research on operant conditioning made him a household name, in part because he applied his findings about animal behavior to human behavior.

6.14 Reinforcement is any consequence of a behavior that makes that behavior more likely to recur.

6.15 Positive reinforcement involves getting something desirable, while negative reinforcement involves removing something undesirable.

6.16 A reinforcement schedule is a pattern by which reinforcement occurs in response to a particular behavior. Continuous reinforcement is a pattern by which a behavior is reinforced every time it occurs, while partial reinforcement is a pattern by which a behavior is reinforced only some of the times it occurs. A fixed-ratio schedule is a reinforcement schedule in which a behavior is reinforced after a consistent, predictable number of occurrences. By contrast, a variable-ratio schedule is a reinforcement schedule in which a behavior is reinforced after an inconsistent, unpredictable number of occurrences. A fixed-interval schedule is a reinforcement schedule in which a behavior can be reinforced after a time interval that is consistent and predictable. By contrast, a variable-interval schedule is a reinforcement schedule in which a behavior can be reinforced after a time interval that is inconsistent and unpredictable.

6.17 Punishment is any consequence of a behavior that makes that behavior less likely to recur.

6.18 Recognizing a discriminative stimulus allows a person to act when the chances of obtaining reinforcement are greatest and the chances of getting punished are least.

6.19 Shaping is the process of gradually learning a complex behavior through the reinforcement of each of its small steps.

6.20 Generalization, discrimination, acquisition, and extinction are all concepts that occur in both classical conditioning and operant conditioning.

Observational Learning

6.21 Observational learning is learning that occurs as a result of observing others' behavior and consequences rather than our own.

6.22 Albert Bandura's Bobo doll studies demonstrated the power of modeling, imitation of observed behavior.

6.23 Mirror neurons are thought to underlie empathy and imitation and to activate when a person performs or observes a particular behavior.

Biological Influences on Learning

6.24 Biological preparedness is an animal's evolutionary predisposition to learn what is most relevant to the survival of that species.

6.25 John Garcia's research on taste aversion provided solid evidence for biological preparedness.

6.26 Instinctive drift is the tendency of animals' behavior to return to genetically programmed patterns, making it difficult to teach animals behavior that is inconsistent with instinct.

Cognitive Influences on Learning

6.27 Cognition, or thought, influences learning more than the original learning researchers believed it did.

6.28 A cognitive map is a mental diagram of a physical environment that can speed up the learning process.

6.29 Latent learning is learning that has taken place but cannot be directly observed until it is given a chance to be performed.

6.30 Insight is the perception of a solution to a problem that results from cognitive understanding and that allows one to skip some of the steps of trial-and-error learning.

6.31 Learned helplessness is the absence of any attempt to help oneself, resulting from previously learning that the situation is outside of one's control.

KEY TERMS

SELF-ASSESSMENT

1. When a person salivates to the sight of a logo on a pizza box, that salivation is a(n) ______ ______.
   a. unconditioned response
   b. conditioned response
   c. unconditioned stimulus
   d. conditioned stimulus

2. A child has learned through experience that a certain bell sound means that the ice cream truck is nearby, and she responds to that bell with excitement. When that child reacts with similar excitement to a similar-sounding bell, she's exemplifying ______.
   a. extinction
   b. generalization
   c. biological preparedness
   d. shaping

3. Conditioning that takes places through observation of others' life experiences rather than one's own is known as ______ ______.
   a. vicarious conditioning
   b. higher-order conditioning
   c. operant conditioning
   d. classical conditioning

4. ______ is any consequence of a behavior that makes that behavior more likely to recur.
   a. Reinforcement
   b. Acquisition
   c. Generalization
   d. Punishment

5. A ______ ______ schedule is a reinforcement schedule in which a behavior is reinforced after an unpredictable number of occurrences—like winning money by buying lottery tickets.
   a. fixed-ratio
   b. variable-ratio
   c. fixed-interval
   d. variable-interval

6. A ______ ______ is a signal indicating that a particular behavior will be followed by a particular consequence.

7. When an animal trainer teaches a dolphin to jump out of the water and through a hoop by reinforcing each of the smaller behaviors required to do that action, the learning process is known as ______.

8. ______ ______ is an animal's evolutionary predisposition to learn what is most relevant to the survival of that species.

9. If a teenager—who has never driven a car before but has watched others driving many times—can drive well on her first attempt, then she is probably exhibiting ______ ______.
   a. biological preparedness
   b. classical conditioning
   c. latent learning
   d. spontaneous recovery

10. ______ ______ is the absence of any attempt to help oneself after learning through experience that the situation is outside of one's control.

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Self-Assessment Answers

1. b 2. b 3. a 4. a 5. b 6. discriminative stimulus 7. shaping
8. Biological preparedness 9. c 10. Learned helplessness

WHAT'S YOUR TAKE?

1. Before Pavlov intentionally conditioned his dogs to salivate to previously neutral stimuli (like the bell), they were classically conditioned by accident. The dogs picked up on sights and sounds that regularly occurred before they were given food in the lab, and soon those sights and sounds triggered anticipatory mouth-watering. Our own pets get classically conditioned by accident too. My childhood dog came running and jumped with excitement whenever she heard the crinkle of her bag of treats. We never intended for her to make this association, but over time, she learned that the sound of that particular bag meant that a treat would soon follow.

How have your own pets demonstrated this kind of accidental classical conditioning? What kinds of previously neutral stimuli—the sight of the leash, the sound of the electric can opener, and so on—have they identified as precursors to food? What kinds of conditioned reactions do your pets show to those stimuli now? Are there other unconditioned stimuli besides food that your dog has been conditioned to anticipate? If so, what are they, and what conditioned responses have they developed?

2. Texting while driving is dangerous. In fact, some studies have found that texting drivers were more likely to miss the brake lights of the car in front of them, swerve out of their lane, and take their eyes off the road than were drivers talking on phones or drivers who were drunk (Crisler et al., 2008; Libby & Chaparro, 2009; Hosking et al., 2009; Drews et al., 2009). Any one of these mistakes could result in injury or death to the driver or someone else.

Based on the risk of texting while driving and what you know about operant conditioning, how would you change this behavior? What punishment would you enforce? What form would it take—a fine, jail time, a suspended driver's license, or something else? How severe should the punishments be? Would reinforcement (for *not* texting) be part of your contingency system?

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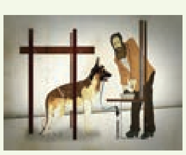

6.1 Classical Conditioning

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This video offers some good examples and explanations of classical conditioning.

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