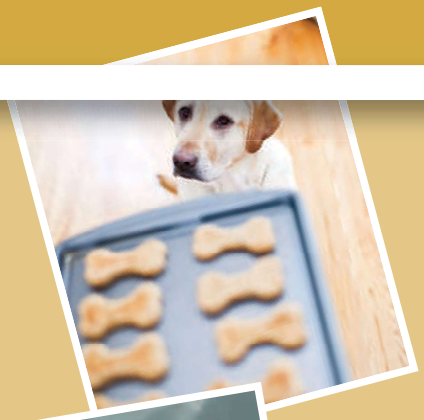
Unit VI



Learning

Modules

When a chinook salmon first emerges from its egg in a stream's gravel bed, its genes provide most of the behavioral instructions it needs for life. It knows instinctively how and where to swim, what to eat, and most spectacularly, where to go and when and how to return to its birthplace. Guided by the scent of its home stream, it pursues an upstream odyssey to its ancestral spawning ground and seeks out the best gravel and water flow for breeding. It then mates and, its life mission accomplished, dies.

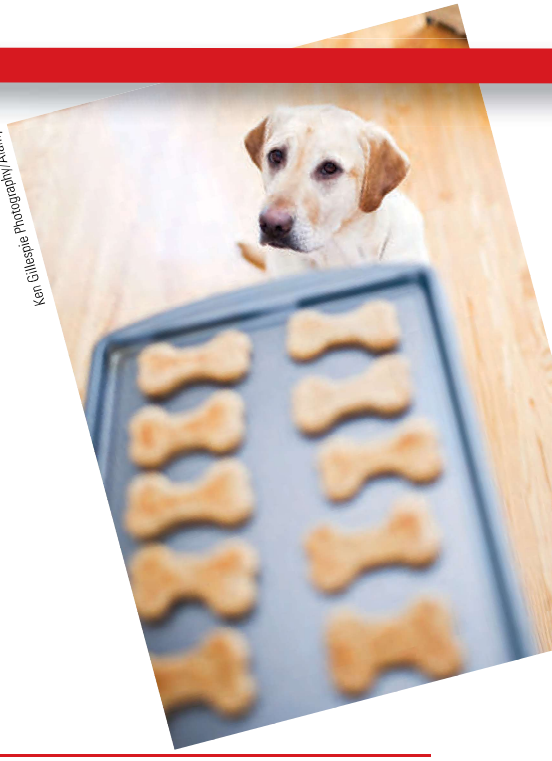
Unlike salmon, we are not born with a genetic plan for life. Much of what we do we learn from experience. Although we struggle to find the life direction a salmon is born with, our learning gives us more flexibility. We can learn how to build grass huts or snow shelters, submarines or space stations, and thereby adjust to almost any environment. Indeed, nature's most important gift to us may be our *adaptability*—our capacity to learn new behaviors that help us cope with changing circumstances.

Learning breeds hope. What is learnable we can potentially teach—a fact that encourages parents, teachers, coaches, and animal trainers. What has been learned we can potentially change by new learning—an assumption that underlies counseling, psychotherapy, and rehabilitation programs. No matter how unhappy, unsuccessful, or unloving we are, that need not be the end of our story.

No topic is closer to the heart of psychology than *learning*. In earlier units we considered how we learn to think critically, and the learning of visual perceptions and of a drug's expected effect. In later units we will see how learning shapes our thoughts and language, our motivations and emotions, our personalities and attitudes. In Unit VII, we will see how the brain stores and retrieves learning.

Module 26

How We Learn and Classical Conditioning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Module Learning Objectives

26-1 Define learning, and identify some basic forms of learning.

26-2 Describe the basic components of classical conditioning, and explain behaviorism's view of learning.

26-3 Summarize the processes of acquisition, extinction, spontaneous recovery, generalization, and discrimination.

26-4 Explain why Pavlov's work remains so important, and describe some applications of his work to human health and well-being.

How Do We Learn?

26-1 What is learning, and what are some basic forms of learning?

Psychologists define **learning** as the process of acquiring new and relatively enduring information or behaviors. By learning, we humans are able to adapt to our environments. We learn to expect and prepare for significant events such as food or pain *(classical conditioning)*. We typically learn to repeat acts that bring rewards and to avoid acts that bring unwanted results *(operant conditioning)*. We learn new behaviors by observing events and by watching others, and through language we learn things we have neither experienced nor observed *(cognitive learning)*. But *how* do we learn?

learning the process of acquiring new and relatively enduring information or behaviors.

More than 200 years ago, philosophers such as John Locke and David Hume echoed Aristotle's conclusion from 2000 years earlier: We learn by *association.* Our minds naturally

Try This

Most of us would be unable to name the order of the songs on our favorite album or playlist. Yet, hearing the end of one piece cues (by association) an anticipation of the next. Likewise, when singing your national anthem, you associate the end of each line with the beginning of the next. (Pick a line out of the middle and notice how much harder it is to recall the *previous* line.)

AP® Exam Tip

It's easy to confuse habituation with sensory adaptation, a concept from Unit IV. Recall that sensory adaptation occurs when one of your sensory systems stops registering the presence of an unchanging stimulus—when you go swimming in a cool pool, for example, the water no longer feels cool after you've been in for a few minutes. Habituation, like sensory adaptation, involves a diminished response, but in this case it's a form of learning rather than a function of the sensory system. If you're exposed to the same stimulus over and over, your response decreases. A friend might sneak up and startle you by yelling "Boo!" But you'll probably startle less when he tries it again two minutes later. That's habituation.

habituation an organism's decreasing response to a stimulus with repeated exposure to it.

associative learning learning that certain events occur together. The events may be two stimuli (as in classical conditioning) or a response and its consequences (as in operant conditioning).

stimulus any event or situation that evokes a response.

connect events that occur in sequence. Suppose you see and smell freshly baked bread, eat some, and find it satisfying. The next time you see and smell fresh bread, you will expect that eating it will again be satisfying. So, too, with sounds. If you associate a sound with a frightening consequence, hearing the sound alone may trigger your fear. As one 4-year-old exclaimed after watching a TV character get mugged, "If I had heard that music, I wouldn't have gone around the corner!" (Wells, 1981).

Learned associations often operate subtly. Give people a red pen (associated with error marking) rather than a black pen and, when correcting essays, they will spot more errors and give lower grades (Rutchick et al., 2010). When voting, people are more likely to support taxes to aid education if their assigned voting place is in a school (Berger et al., 2008).

Learned associations also feed our habitual behaviors (Wood & Neal, 2007). As we repeat behaviors in a given context—sleeping in a certain posture in bed, walking certain routes from class to class, eating popcorn in a movie theater—the behaviors become associated with the contexts. Our next experience of the context then evokes our habitual response. How long does it take to form such habits? To find out, one British research team asked 96 university students to choose some healthy behavior (such as running before dinner or eating fruit with lunch), to do it daily for 84 days, and to record whether the behavior felt automatic (something they did without thinking and would find it hard not to do). On average, behaviors became habitual after about 66 days (Lally et al., 2010). (Is there something you'd like to make a routine part of your life? Just do it every day for two months, or a bit longer for exercise, and you likely will find yourself with a new habit.)

Other animals also learn by association. Disturbed by a squirt of water, the sea slug *Aplysia* protectively withdraws its gill. If the squirts continue, as happens naturally in choppy water, the withdrawal response diminishes. We say the slug **habituates.** But if the sea slug repeatedly receives an electric shock just after being squirted, its response to the squirt instead grows stronger. The animal has associated the squirt with the impending shock.

Complex animals can learn to associate their own behavior with its outcomes. An aquarium seal will repeat behaviors, such as slapping and barking, that prompt people to toss it a herring.

By linking two events that occur close together, both animals are exhibiting **associative learning.** The sea slug associates the squirt with an impending shock; the seal associates slapping and barking with a herring treat. Each animal has learned something important to its survival: predicting the immediate future.

This process of learning associations is *conditioning,* and it takes two main forms:

- In *classical conditioning,* we learn to associate two stimuli and thus to anticipate events. (A **stimulus** is any event or situation that evokes a response.) We learn that a flash of lightning signals an impending crack of thunder; when lightning flashes nearby, we start to brace ourselves (**FIGURE 26.1**).
- In *operant conditioning,* we learn to associate a response (our behavior) and its consequence. Thus we (and other animals) learn to repeat acts followed by good results (**FIGURE 26.2**) and avoid acts followed by bad results.

To simplify, we will explore these two types of associative learning separately. Often, though, they occur together, as on one Japanese cattle ranch, where the clever rancher outfitted his herd with electronic pagers, which he calls from his cell phone. After a week of training, the animals learn to associate two stimuli—the beep on their pager and the arrival of food (classical conditioning). But they also learn to associate their hustling to the food trough with the pleasure of eating (operant conditioning).

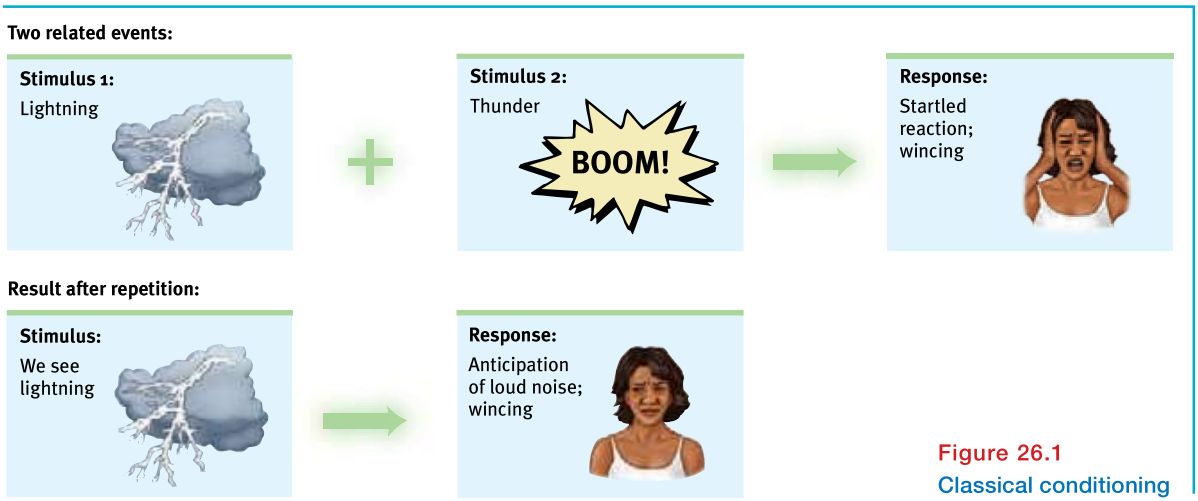


Figure 26.1
Classical conditioning

Conditioning is not the only form of learning. Through **cognitive learning** we acquire mental information that guides our behavior. *Observational learning,* one form of cognitive learning, lets us learn from others' experiences. Chimpanzees, for example, sometimes learn behaviors merely by watching others perform them. If one animal sees another solve a puzzle and gain a food reward, the observer may perform the trick more quickly. So, too, in humans: We look and we learn.

Let's look more closely now at classical conditioning.

(a) Response: Being polite (b) Consequence: Getting a treat (c) Behavior strengthened

Figure 26.2
Operant conditioning

cognitive learning the acquisition of mental information, whether by observing events, by watching others, or through language.

Before You Move On

▶ ASK YOURSELF

Can you remember some example from your childhood of learning through classical conditioning—perhaps salivating at the sound or smell of some delicious food cooking in your family kitchen? Can you remember an example of operant conditioning, when you repeated (or decided not to repeat) a behavior because you liked (or hated) its consequences? Can you recall watching someone else perform some act and later repeating or avoiding that act?

▶ TEST YOURSELF

As we develop, we learn cues that lead us to expect and prepare for good and bad events. We learn to repeat behaviors that bring rewards. And we watch others and learn. What do psychologists call these three types of learning?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

classical conditioning a type of learning in which one learns to link two or more stimuli and anticipate events.

behaviorism the view that psychology (1) should be an objective science that (2) studies behavior without reference to mental processes. Most research psychologists today agree with (1) but not with (2).

neutral stimulus (NS) in classical conditioning, a stimulus that elicits no response before conditioning.

Classical Conditioning

26-2 What are the basic components of classical conditioning, and what was behaviorism's view of learning?

For many people, the name Ivan Pavlov (1849–1936) rings a bell. His early twentieth-century experiments—now psychology's most famous research—are classics, and the phenomenon he explored we justly call **classical conditioning.**

Pavlov's work laid the foundation for many of psychologist John B. Watson's ideas. In searching for laws underlying learning, Watson (1913) urged his colleagues to discard reference to inner thoughts, feelings, and motives. The science of psychology should instead study how organisms respond to stimuli in their environments, said Watson: "Its theoretical goal is the prediction and control of behavior. Introspection forms no essential part of its methods." Simply said, psychology should be an objective science based on observable behavior.

Ivan Pavlov "Experimental investigation . . . should lay a solid foundation for a future true science of psychology" (1927).

This view, which influenced North American psychology during the first half of the twentieth century, Watson called **behaviorism.** Pavlov and Watson shared both a disdain for "mentalistic" concepts (such as consciousness) and a belief that the basic laws of learning were the same for all animals—whether dogs or humans. Few researchers today propose that psychology should ignore mental processes, but most now agree that classical conditioning is a basic form of learning by which all organisms adapt to their environment.

Pavlov's Experiments

Pavlov was driven by a lifelong passion for research. After setting aside his initial plan to follow his father into the Russian Orthodox priesthood, Pavlov received a medical degree at age 33 and spent the next two decades studying the digestive system. This work earned him Russia's first Nobel Prize in 1904. But his novel experiments on learning, which consumed the last three decades of his life, earned this feisty scientist his place in history.

PEANUTS

Pavlov's new direction came when his creative mind seized on an incidental observation. Without fail, putting food in a dog's mouth caused the animal to salivate. Moreover, the dog began salivating not only at the taste of the food, but also at the mere sight of the food, or at the food dish, or at the person delivering the food, or even at the sound of that person's approaching footsteps. At first, Pavlov considered these "psychic secretions" an annoyance—until he realized they pointed to a simple but important form of learning.

Pavlov and his assistants tried to imagine what the dog was thinking and feeling as it drooled in anticipation of the food. This only led them into fruitless debates. So, to explore the phenomenon more objectively, they experimented. To eliminate other possible influences, they isolated the dog in a small room, secured it in a harness, and attached a device to divert its saliva to a measuring instrument (**FIGURE 26.3**). From the next room, they presented food—first by sliding in a food bowl, later by blowing meat powder into the dog's mouth at a precise moment. They then paired various **neutral stimuli (NS)**—events the dog could see or hear but didn't associate with food—with food in the dog's mouth. If a sight or sound regularly signaled the arrival of food, would the dog learn the link? If so, would it begin salivating in anticipation of the food?

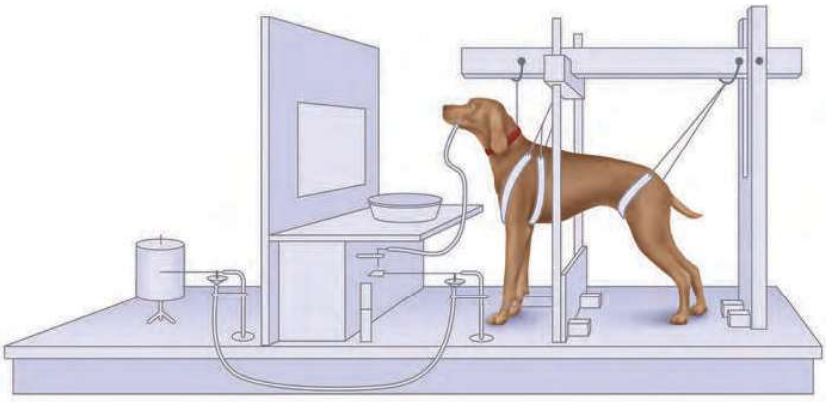


Figure 26.3
Pavlov's device for recording salivation A tube in the dog's cheek collects saliva, which is measured in a cylinder outside the chamber.

The answers proved to be *Yes* and *Yes.* Just before placing food in the dog's mouth to produce salivation, Pavlov sounded a tone. After several pairings of tone and food, the dog, now anticipating the meat powder, began salivating to the tone alone. In later experiments, a buzzer,[1] a light, a touch on the leg, even the sight of a circle set off the drooling. (This procedure works with people, too. When hungry young Londoners viewed abstract figures before smelling peanut butter or vanilla, their brain soon responded in anticipation to the abstract images alone [Gottfried et al., 2003].)

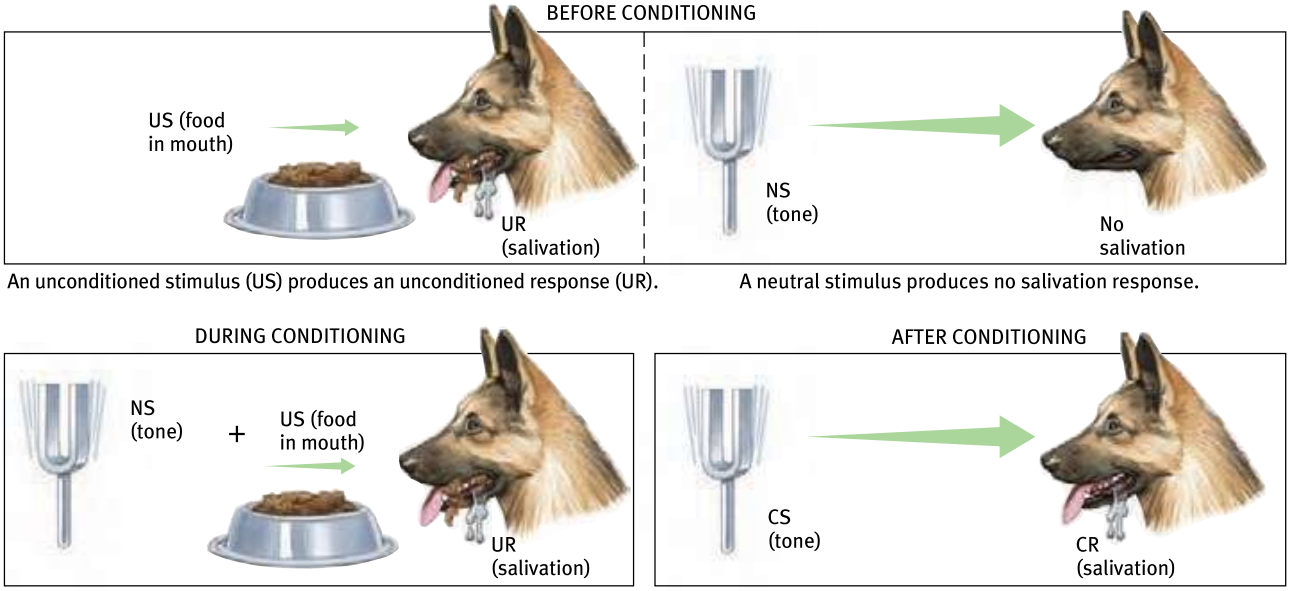
A dog doesn't learn to salivate in response to food in its mouth. Food in the mouth automatically, *unconditionally,* triggers a dog's salivary reflex (**FIGURE 26.4**). Thus, Pavlov called the drooling an **unconditioned response (UR).** And he called the food an **unconditioned stimulus (US).**

unconditioned response (UR) in classical conditioning, an unlearned, naturally occurring response (such as salivation) to an unconditioned stimulus (US) (such as food in the mouth).

unconditioned stimulus (US) in classical conditioning, a stimulus that unconditionally—naturally and automatically—triggers a response (UR).

[1] The "buzzer" (English translation) was perhaps Pavlov's supposed bell—a small electric bell (Tully, 2003).

Figure 26.4
Pavlov's classic experiment Pavlov presented a neutral stimulus (a tone) just before an unconditioned stimulus (food in mouth). The neutral stimulus then became a conditioned stimulus, producing a conditioned response.



conditioned response (CR) in classical conditioning, a learned response to a previously neutral (but now conditioned) stimulus (CS).

conditioned stimulus (CS) in classical conditioning, an originally irrelevant stimulus that, after association with an unconditioned stimulus (US), comes to trigger a conditioned response (CR).

acquisition in classical conditioning, the initial stage, when one links a neutral stimulus and an unconditioned stimulus so that the neutral stimulus begins triggering the conditioned response. In operant conditioning, the strengthening of a reinforced response.

higher-order conditioning a procedure in which the conditioned stimulus in one conditioning experience is paired with a new neutral stimulus, creating a second (often weaker) conditioned stimulus. For example, an animal that has learned that a tone predicts food might then learn that a light predicts the tone and begin responding to the light alone. (Also called *second-order conditioning*.)

Salivation in response to the tone, however, is learned. Because it is *conditional* upon the dog's associating the tone and the food, we call this response the **conditioned response (CR).** The stimulus that used to be neutral (in this case, a previously meaningless tone that now triggers the salivation) is the **conditioned stimulus (CS).** Distinguishing these two kinds of stimuli and responses is easy: Conditioned = learned; *un*conditioned = *un*learned.

Let's check your understanding with a second example. An experimenter sounds a tone just before delivering an air puff to your blinking eye. After several repetitions, you blink to the tone alone. What is the NS? The US? The UR? The CS? The CR?[2]

If Pavlov's demonstration of associative learning was so simple, what did he do for the next three decades? What discoveries did his research factory publish in his 532 papers on salivary conditioning (Windholz, 1997)? He and his associates explored five major conditioning processes: *acquisition, extinction, spontaneous recovery, generalization,* and *discrimination.*

ACQUISITION

26-3 In classical conditioning, what are the processes of acquisition, extinction, spontaneous recovery, generalization, and discrimination?

To understand the **acquisition,** or initial learning, of the stimulus-response relationship, Pavlov and his associates had to confront the question of timing: How much time should elapse between presenting the NS (the tone, the light, the touch) and the US (the food)? In most cases, not much—half a second usually works well.

What do you suppose would happen if the food (US) appeared before the tone (NS) rather than after? Would conditioning occur? Not likely. With but a few exceptions, conditioning doesn't happen when the NS follows the US. *Remember, classical conditioning is biologically adaptive because it helps humans and other animals prepare for good or bad events.* To Pavlov's dogs, the originally neutral tone became a (CS) after signaling an important biological event—the arrival of food (US). To deer in the forest, the snapping of a twig (CS) may signal a predator's approach (US). If the good or bad event has already occurred, the tone or the sound won't help the animal prepare.

Eric Isselée/Shutterstock

More recent research on male Japanese quail shows how a CS can signal another important biological event (Domjan, 1992, 1994, 2005). Just before presenting an approachable female quail, the researchers turned on a red light. Over time, as the red light continued to herald the female's arrival, the light caused the male quail to become excited. They developed a preference for their cage's red-light district, and when a female appeared, they mated with her more quickly and released more semen and sperm (Matthews et al., 2007). All in all, the quail's capacity for classical conditioning gives it a reproductive edge.

In humans, too, objects, smells, and sights associated with sexual pleasure can become conditioned stimuli for sexual arousal (Byrne, 1982). Onion breath does not usually produce sexual arousal. But when repeatedly paired with a passionate kiss, it can become a CS and do just that (**FIGURE 26.5**). The larger lesson: *Conditioning helps an animal survive and reproduce—by responding to cues that help it gain food, avoid dangers, locate mates, and produce offspring* (Hollis, 1997).

Through **higher-order conditioning,** a new NS can become a new CS. All that's required is for it to become associated with a previously conditioned stimulus. If a tone regularly signals food and produces salivation, then a light that becomes associated with

FYI

Remember:
NS = **N**eutral **S**timulus
US = **U**nconditioned **S**timulus
UR = **U**nconditioned **R**esponse
CS = **C**onditioned **S**timulus
CR = **C**onditioned **R**esponse

[2] NS = tone before procedure; US = air puff; UR = blink to air puff; CS = tone after procedure; CR = blink to tone

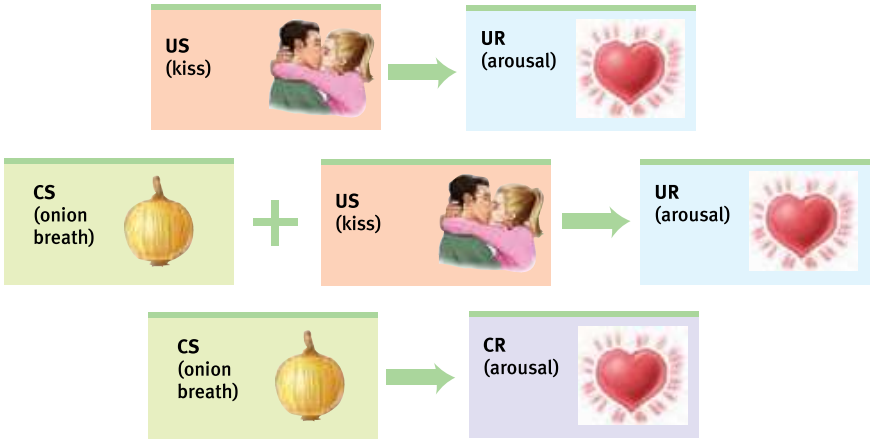


Figure 26.5
An unexpected CS Psychologist Michael Tirrell (1990) recalled: "My first girlfriend loved onions, so I came to associate onion breath with kissing. Before long, onion breath sent tingles up and down my spine. Oh what a feeling!"

the tone may also begin to trigger salivation. Although this higher-order conditioning (also called *second-order conditioning*) tends to be weaker than first-order conditioning, it influences our everyday lives. Imagine that something makes us very afraid (perhaps a guard dog associated with a previous dog bite). If something else, such as the sound of a barking dog, brings to mind that guard dog, the bark alone may make us feel a little afraid.

EXTINCTION AND SPONTANEOUS RECOVERY

What would happen, Pavlov wondered, if after conditioning, the CS occurred repeatedly without the US? If the tone sounded again and again, but no food appeared, would the tone still trigger salivation? The answer was mixed. The dogs salivated less and less, a reaction known as **extinction,** the diminished responding that occurs when the CS (tone) no longer signals an impending US (food). But a different picture emerged when Pavlov allowed several hours to elapse before sounding the tone again. After the delay, the dogs would again begin salivating to the tone (**FIGURE 26.6**). This **spontaneous recovery**—the reappearance of a (weakened) CR after a pause—suggested to Pavlov that extinction was *suppressing* the CR rather than eliminating it.

GENERALIZATION

Pavlov and his students noticed that a dog conditioned to the sound of one tone also responded somewhat to the sound of a new and different tone. Likewise, a dog conditioned to salivate when rubbed would also drool a bit when scratched (Windholz, 1989) or when touched on a different body part (**FIGURE 26.7** on the next page). This tendency to respond likewise to stimuli similar to the CS is called **generalization.**

extinction the diminishing of a conditioned response; occurs in classical conditioning when an unconditioned stimulus (US) does not follow a conditioned stimulus (CS); occurs in operant conditioning when a response is no longer reinforced.

spontaneous recovery the reappearance, after a pause, of an extinguished conditioned response.

generalization the tendency, once a response has been conditioned, for stimuli similar to the conditioned stimulus to elicit similar responses.

AP® Exam Tip

Spontaneous recovery is, in fact, spontaneous. Notice that the extinguished conditioned response returns without any additional pairing with the unconditioned stimulus. It is not a form of acquisition.

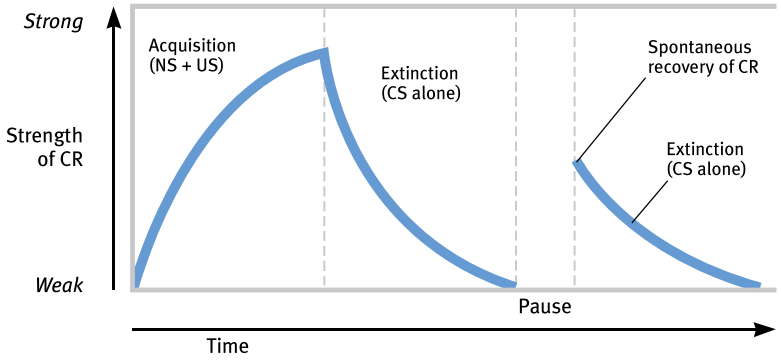
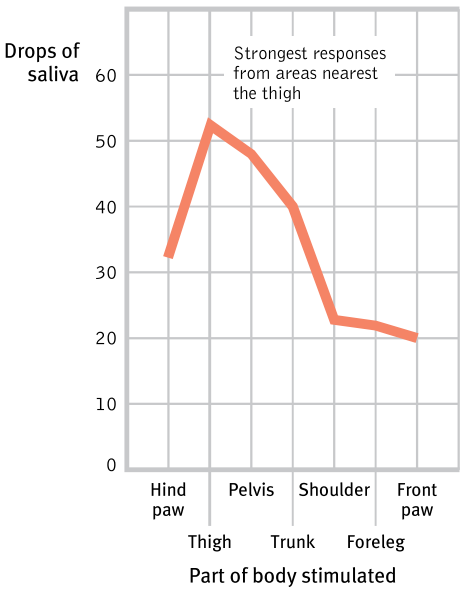
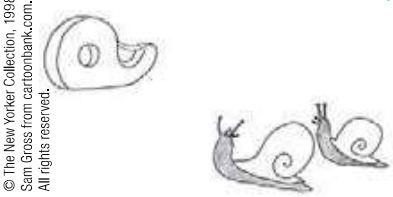


Figure 26.6
Idealized curve of acquisition, extinction, and spontaneous recovery The rising curve shows that the CR rapidly grows stronger as the NS becomes a CS as it is repeatedly paired with the US *(acquisition)*, then weakens as the CS is presented alone *(extinction)*. After a pause, the CR reappears *(spontaneous recovery)*.

Figure 26.7

Generalization Pavlov demonstrated generalization by attaching miniature vibrators to various parts of a dog's body. After conditioning salivation to stimulation of the thigh, he stimulated other areas. The closer a stimulated spot was to the dog's thigh, the stronger the conditioned response. (From Pavlov, 1927.)





"I don't care if she's a tape dispenser. I love her."

Generalization can be adaptive, as when toddlers taught to fear moving cars also become afraid of moving trucks and motorcycles. And generalized fears can linger. One Argentine writer who underwent torture still recoils with fear when he sees black shoes—his first glimpse of his torturers as they approached his cell. Generalized anxiety reactions have been demonstrated in laboratory studies comparing abused with nonabused children. When an angry face appears on a computer screen, abused children's brain-wave responses are dramatically stronger and longer lasting (Pollak et al., 1998).

Stimuli similar to naturally disgusting objects will, by association, also evoke some disgust, as otherwise desirable fudge does when shaped to resemble dog feces (Rozin et al., 1986). Researchers have also found that we like unfamiliar people more if they look somewhat like someone we've learned to like rather than dislike (Verosky & Todorov, 2010). (They find this by subtly morphing the facial features of someone we've learned to like or dislike onto a novel face.) In each of these human examples, people's emotional reactions to one stimulus have generalized to similar stimuli.

AP® Exam Tip

Generalization and discrimination are introduced in this module, but they don't just apply to classical conditioning. These two concepts will show up in other types of learning as well.

DISCRIMINATION

Pavlov's dogs also learned to respond to the sound of a particular tone and *not* to other tones. This learned ability to *distinguish* between a conditioned stimulus (which predicts the US) and other irrelevant stimuli is called **discrimination.** Being able to recognize differences is adaptive. Slightly different stimuli can be followed by vastly different consequences. Confronted by a guard dog, your heart may race; confronted by a guide dog, it probably will not.

discrimination in classical conditioning, the learned ability to distinguish between a conditioned stimulus and stimuli that do not signal an unconditioned stimulus.

Before You Move On

▶ ASK YOURSELF

How have your emotions or behaviors been classically conditioned?

▶ TEST YOURSELF

In slasher movies, sexually arousing images of women are sometimes paired with violence against women. Based on classical conditioning principles, what might be an effect of this pairing?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

Pavlov's Legacy

26-4 Why does Pavlov's work remain so important, and what have been some applications of his work to human health and well-being?

What remains today of Pavlov's ideas? A great deal. Most psychologists now agree that classical conditioning is a basic form of learning. Judged by today's knowledge of the interplay of our biology, psychology, and social-cultural environment, Pavlov's ideas were incomplete. But if we see further than Pavlov did, it is because we stand on his shoulders.

Why does Pavlov's work remain so important? If he had merely taught us that old dogs can learn new tricks, his experiments would long ago have been forgotten. Why should we care that dogs can be conditioned to salivate at the sound of a tone? The importance lies first in this finding: *Many other responses to many other stimuli can be classically conditioned in many other organisms*—in fact, in every species tested, from earthworms to fish to dogs to monkeys to people (Schwartz, 1984). Thus, classical conditioning is one way that virtually all organisms learn to adapt to their environment.

Second, *Pavlov showed us how a process such as learning can be studied objectively.* He was proud that his methods involved virtually no subjective judgments or guesses about what went on in a dog's mind. The salivary response is a behavior measurable in cubic centimeters of saliva. Pavlov's success therefore suggested a scientific model for how the young discipline of psychology might proceed—by isolating the basic building blocks of complex behaviors and studying them with objective laboratory procedures.

APPLICATIONS OF CLASSICAL CONDITIONING

Other units in this text—on consciousness, motivation, emotion, health, psychological disorders, and therapy—show how Pavlov's principles can influence human health and well-being. Two examples:

- Former drug users often feel a craving when they are again in the drug-using context—with people or in places they associate with previous highs. Thus, drug counselors advise addicts to steer clear of people and settings that may trigger these cravings (Siegel, 2005).
- Classical conditioning even works on the body's disease-fighting immune system. When a particular taste accompanies a drug that influences immune responses, the taste by itself may come to produce an immune response (Ader & Cohen, 1985).

Pavlov's work also provided a basis for Watson's (1913) idea that human emotions and behaviors, though biologically influenced, are mainly a bundle of conditioned responses. Working with an 11-month-old, Watson and Rosalie Rayner (1920; Harris, 1979) showed how specific fears might be conditioned. Like most infants, "Little Albert" feared loud noises but not white rats. Watson and Rayner presented a white rat and, as Little Albert reached to touch it, struck a hammer against a steel bar just behind his head. After seven repeats of seeing the rat and hearing the frightening noise, Albert burst into tears at the mere sight of the rat. Five days later, he had generalized this startled fear reaction to the sight of a rabbit, a dog, and a sealskin coat, but not to dissimilar objects, such as toys.

For years, people wondered what became of Little Albert. Not until 2009 did some psychologist-sleuths identify him as Douglas Merritte, the son of a campus hospital wet nurse who received $1 for her tot's participation. Sadly, Albert died at age 6, apparently having suffered all his short life from congenital hydrocephalus, complicated later by meningitis. This brain damage probably influenced his behavior during Watson and Rayner's experiment (Beck et al., 2009, 2010; Fridlund et al., 2012a,b). People also wondered what became of Watson. After losing his Johns Hopkins professorship over an affair with Rayner (whom he later married), he joined an advertising agency as the company's resident psychologist. There he used his knowledge of associative learning to conceive many successful advertising campaigns, including one for Maxwell House that helped make the "coffee break" an American custom (Hunt, 1993).

John B. Watson Watson (1924) admitted to "going beyond my facts" when offering his famous boast: "Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief, and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors."

Both images Archives of the History of American Psychology, The University of Akron

Little Albert In Watson and Rayner's experiments, "Little Albert" learned to fear a white rat after repeatedly experiencing a loud noise as the rat was presented. In this experiment, what was the US? The UR? The NS? The CS? The CR?

ANSWERS: The US was the loud noise; the UR was the fear response; the NS was the rat before it was paired with the noise; the CS was the rat after pairing; the CR was fear.

The treatment of Little Albert would be unacceptable by today's ethical standards. Also, some psychologists, noting that the infant's fear wasn't learned quickly, had difficulty repeating Watson and Rayner's findings with other children. Nevertheless, Little Albert's learned fears led many psychologists to wonder whether each of us might be a walking repository of conditioned emotions. If so, might extinction procedures or even new conditioning help us change our unwanted responses to emotion-arousing stimuli? One patient, who for 30 years had feared going into an elevator alone, did just that. Following his therapist's advice, he forced himself to enter 20 elevators a day. Within 10 days, his fear had nearly vanished (Ellis & Becker, 1982). With support from AirTran, comedian-writer Mark Malkoff likewise extinguished his fear of flying. He lived on an airplane for 30 days, taking 135 flights that had him in the air 14 hours a day (NPR, 2009). After a week and a half, his fears had faded and he began playing games with fellow passengers. (His favorite antic was the "toilet paper experiment": He'd put one end of a roll in the toilet, unroll the rest down the aisle, and flush. The entire roll would be sucked down in three seconds.) In Units XII and XIII we will see more examples of how psychologists use behavioral techniques to treat emotional disorders and promote personal growth.

Module 26 Review

26-1 What is learning, and what are some basic forms of learning?

- *Learning* is the process of acquiring new and relatively enduring information or behaviors.
- In *associative learning,* we learn that certain events occur together.
- In classical conditioning, we learn to associate two or more stimuli (a *stimulus* is any event or situation that evokes a response).
- In operant conditioning, we learn to associate a response and its consequences.
- Through *cognitive learning,* we acquire mental information that guides our behavior. For example, in observational learning, we learn new behaviors by observing events and watching others.

26-2 What are the basic components of classical conditioning, and what was behaviorism's view of learning?

- *Classical conditioning* is a type of learning in which an organism comes to associate stimuli.
- In classical conditioning, an *NS* is a stimulus that elicits no response before conditioning.
- A *UR* is an event that occurs naturally (such as salivation), in response to some stimulus.
- A *US* is something that naturally and automatically (without learning) triggers the unlearned response (as food in the mouth triggers salivation).
- A *CS* is a previously neutral stimulus (such as a tone) that, after association with a US (such as food) comes to trigger a CR.
- A *CR* is the learned response (salivating) to the originally neutral (but now conditioned) stimulus.
- Ivan Pavlov's work on classical conditioning laid the foundation for *behaviorism,* the view that psychology should be an objective science that studies behavior without reference to mental processes.
- The behaviorists believed that the basic laws of learning are the same for all species, including humans.

26-3 In classical conditioning, what are the processes of acquisition, extinction, spontaneous recovery, generalization, and discrimination?

- In classical conditioning, *acquisition* is associating an NS with the US so that the NS begins triggering the CR.
- Acquisition occurs most readily when the NS is presented just before (ideally, about a half-second before) a US, preparing the organism for the upcoming event. This finding supports the view that classical conditioning is biologically adaptive. Through *higher-order conditioning,* a new NS can become a new CS.
- *Extinction* is diminished responding when the CS no longer signals an impending US.
- *Spontaneous recovery* is the appearance of a formerly extinguished response, following a rest period.
- *Generalization* is the tendency to respond to stimuli that are similar to a CS.
- *Discrimination* is the learned ability to distinguish between a CS and other irrelevant stimuli.

26-4 Why does Pavlov's work remain so important, and what have been some applications of his work to human health and well-being?

- Pavlov taught us that significant psychological phenomena can be studied objectively, and that classical conditioning is a basic form of learning that applies to all species.
- Classical conditioning techniques are used to improve human health and well-being in many areas, including therapy for those recovering from drug addiction and for those overcoming fears. The body's immune system may also respond to classical conditioning.

Multiple-Choice Questions

1. Which of the following is best defined as a relatively permanent change in behavior due to experience?
   a. Acquisition
   b. Stimulus
   c. Learning
   d. Habituation
   e. Response

2. Lynn is teaching learning. Every time she claps her hands, Charlie turns off the light. When Randy claps in approval of Lynn's presentation, Charlie does not turn the light off. What concept has Charlie demonstrated?
   a. Habituation
   b. Discrimination
   c. Spontaneous recovery
   d. Extinction
   e. Habituation

3. Classical conditioning is the type of learning in which a person links two or more stimuli and
   a. forgets about them.
   b. lays them out in sequence.
   c. shuts down.
   d. anticipates events.
   e. receives a reward.

4. In classical conditioning, the unconditioned stimulus
   a. naturally triggers a response.
   b. is a naturally occurring response.
   c. is initially irrelevant, and then comes to trigger a response.
   d. objectively studies psychology.
   e. is Pavlovian.

5. Students are accustomed to a bell ringing to indicate the end of a class period. The principal decides to substitute popular music for the bell to indicate the end of each class period. Students quickly respond to the music in the same way they did to the bell. What principle does this illustrate?
   a. Acquisition
   b. Habituation
   c. Generalization
   d. Functional fixedness
   e. Stimulus

6. The work of Ivan Pavlov and John Watson fits best into which of psychology's perspectives?
   a. Humanism
   b. Gestalt psychology
   c. Trait theory
   d. Behaviorism
   e. Neuropsychology

Practice FRQs

1. Carter's goldfish has been classically conditioned to swim to the top of the fish tank every time the light is turned on. This happened because Carter always turns on the light in the room just before feeding the fish. Identify what each of the following would be in this example, making sure you explain why you know your identification is correct.
   - Conditioned response (CR)
   - Conditioned stimulus (CS)
   - Unconditioned stimulus (US)

Answer

1 point: The goldfish swimming to the top of the tank when the light is turned on is the CR because the fish has learned to behave in this way.

1 point: The light is the CS because the goldfish has learned to respond to this stimulus. The light was initially an NS.

1 point: The food is the US because this stimulus will naturally cause the fish to swim to the top of the tank.

2. A researcher paired the sound of a whistle with an air puff to the eye to classically condition Ashley to blink when the whistle alone was sounded. Explain how the researcher could demonstrate the following:
   - Generalization
   - Extinction
   - Spontaneous recovery

(3 points)

Module 27

Operant Conditioning


Henrik Sorensen

Module Learning Objectives

27-1 Describe operant conditioning, and explain how operant behavior is reinforced and shaped.

27-2 Discuss the differences between positive and negative reinforcement, and identify the basic types of reinforcers.

27-3 Explain how the different reinforcement schedules affect behavior.

27-4 Discuss how punishment and negative reinforcement differ, and explain how punishment affects behavior.

27-5 Describe the controversy over Skinner's views of human behavior.

Operant Conditioning

27-1 What is operant conditioning, and how is operant behavior reinforced and shaped?

It's one thing to classically condition a dog to salivate at the sound of a tone, or a child to fear moving cars. To teach an elephant to walk on its hind legs or a child to say *please,* we turn to operant conditioning.

Classical conditioning and operant conditioning are both forms of associative learning, yet their difference is straightforward:

- *Classical conditioning* forms associations between stimuli (a CS and the US it signals). It also involves *respondent behavior*—actions that are automatic responses to a stimulus (such as salivating in response to meat powder and later in response to a tone).
- In **operant conditioning,** organisms associate their own actions with consequences. Actions followed by reinforcers increase; those followed by punishers often decrease. Behavior that *operates* on the environment to *produce* rewarding or punishing stimuli is called *operant behavior.*

AP® Exam Tip

Don't be fooled by the fact that classical conditioning is presented before operant conditioning. Classical conditioning was understood before operant conditioning, but operant conditioning has a larger impact on our day-to-day lives.

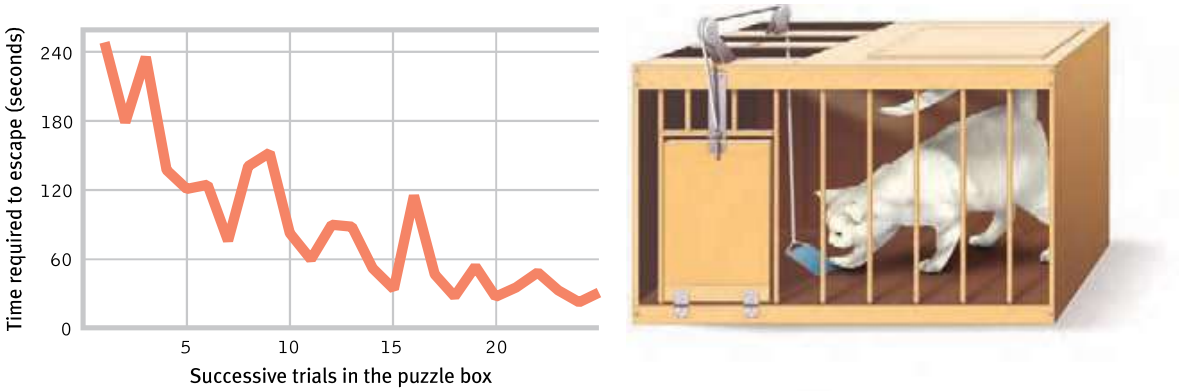
operant conditioning a type of learning in which behavior is strengthened if followed by a reinforcer or diminished if followed by a punisher.

law of effect Thorndike's principle that behaviors followed by favorable consequences become more likely, and that behaviors followed by unfavorable consequences become less likely.

Skinner's Experiments

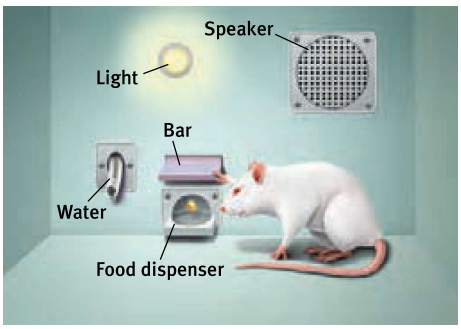
B. F. Skinner (1904–1990) was a college English major and an aspiring writer who, seeking a new direction, entered psychology graduate school. He went on to become modern behaviorism's most influential and controversial figure. Skinner's work elaborated on what psychologist Edward L. Thorndike (1874–1949) called the **law of effect:** Rewarded

Figure 27.1
Cat in a puzzle box Thorndike used a fish reward to entice cats to find their way out of a puzzle box (right) through a series of maneuvers. The cats' performance tended to improve with successive trials (left), illustrating Thorndike's *law of effect.* (Adapted from Thorndike, 1898.)



behavior is likely to recur (**FIGURE 27.1**). Using Thorndike's law of effect as a starting point, Skinner developed a behavioral technology that revealed principles of *behavior control.* These principles also enabled him to teach pigeons such unpigeon-like behaviors as walking in a figure 8, playing Ping-Pong, and keeping a missile on course by pecking at a screen target.

Figure 27.2
A Skinner box Inside the box, the rat presses a bar for a food reward. Outside, a measuring device (not shown here) records the animal's accumulated responses.



For his pioneering studies, Skinner designed an **operant chamber,** popularly known as a *Skinner box* (**FIGURE 27.2**). The box has a bar (a lever) that an animal presses—or a key (a disc) the animal pecks—to release a reward of food or water. It also has a device that records these responses. This design creates a stage on which rats and others animals act out Skinner's concept of **reinforcement:** any event that strengthens (increases the frequency of) a preceding response. What is reinforcing depends on the animal and the conditions. For people, it may be praise, attention, or a paycheck. For hungry and thirsty rats, food and water work well. Skinner's experiments have done far more than teach us how to pull habits out of a rat. They have explored the precise conditions that foster efficient and enduring learning.

operant chamber in operant conditioning research, a chamber (also known as a *Skinner box*) containing a bar or key that an animal can manipulate to obtain a food or water reinforcer; attached devices record the animal's rate of bar pressing or key pecking.

reinforcement in operant conditioning, any event that *strengthens* the behavior it follows.

shaping an operant conditioning procedure in which reinforcers guide behavior toward closer and closer approximations of the desired behavior.

Shaping Behavior

Imagine that you wanted to condition a hungry rat to press a bar. Like Skinner, you could tease out this action with **shaping,** gradually guiding the rat's actions toward the desired behavior. First, you would watch how the animal naturally behaves, so that you could build on its existing behaviors. You might give the rat a bit of food each time it approaches the bar. Once the rat is approaching regularly, you would give the food only when it moves close to the bar, then closer still. Finally, you would require it to touch the bar to get food. With this method of *successive approximations,* you reward responses that are ever-closer to the final desired behavior, and you ignore all other responses. By making rewards contingent on desired behaviors, researchers and animal trainers gradually shape complex behaviors.

Shaping can also help us understand what nonverbal organisms perceive. Can a dog distinguish red and green? Can a baby hear the difference between lower- and higher-pitched tones? If we can shape them to respond to one stimulus and not to another, then we know they can perceive the difference. Such experiments have even shown that some animals can form concepts. When experimenters reinforced pigeons for pecking after


Reuters/CORBIS

Reinforcers vary with circumstances What is reinforcing (a heat lamp) to one animal (a cold meerkat) may not be to another (an overheated child). What is reinforcing in one situation (a cold snap at the Taronga Zoo in Sydney) may not be in another (a sweltering summer day).

seeing a human face, but not after seeing other images, the pigeon's behavior showed that it could recognize human faces (Herrnstein & Loveland, 1964). In this experiment, the human face was a **discriminative stimulus.** Like a green traffic light, discriminative stimuli signal that a response will be reinforced. After being trained to discriminate among classes of events or objects—flowers, people, cars, chairs—pigeons can usually identify the category in which a new pictured object belongs (Bhatt et al., 1988; Wasserman, 1993). They have even been trained to discriminate between the music of Bach and Stravinsky (Porter & Neuringer, 1984).

In everyday life, we continually reinforce and shape others' behavior, said Skinner, though we may not mean to do so. Isaac's whining, for example, annoys his dad, but look how he typically responds:

Isaac: Could you take me to the mall?

Father: *(Ignores Isaac and stays focused on his phone)*

Isaac: Dad, I need to go to the mall.

Father: *(distracted)* Uh, yeah, just a minute.

Isaac: DAAAD! The mall!!

Father: Show some manners! Okay, where are my keys. . .

Isaac's whining is reinforced, because he gets something desirable—his dad's attention. Dad's response is reinforced because it gets rid of something aversive—Isaac's whining.

Or consider a teacher who pastes gold stars on a wall chart beside the names of children scoring 100 percent on spelling tests. As everyone can then see, some children consistently do perfect work. The others, who take the same test and may have worked harder than the academic all-stars, get no rewards. The teacher would be better advised to apply the principles of operant conditioning—to reinforce all spellers for gradual improvements (successive approximations toward perfect spelling of words they find challenging).

discriminative stimulus
in operant conditioning, a stimulus that elicits a response after association with reinforcement (in contrast to related stimuli not associated with reinforcement).

positive reinforcement
increasing behaviors by presenting positive reinforcers. A positive reinforcer is any stimulus that, when *presented* after a response, strengthens the response.

Shaping a dog to play the piano Using a method of successive approximations, with a food reward for each small step—hopping up on the piano bench, putting her paws on the keys, actually making sounds—this dog was taught to "play" the piano, and now does so frequently!


Antonia Brune, Valentine Photography

Types of Reinforcers

27-2 How do positive and negative reinforcement differ, and what are the basic types of reinforcers?

Up to now, we've mainly been discussing **positive reinforcement,** which strengthens a response by *presenting* a typically pleasurable stimulus after a response. But, as we saw in the whining Isaac story, there are *two* basic kinds of reinforcement (**TABLE 27.1** on the next page).

Table 27.1 Ways to Increase Behavior

Operant Conditioning Term	Description	Examples
Positive reinforcement	Add a desirable stimulus	Pet a dog that comes when you call it; pay the person who paints your house
Negative reinforcement	Remove an aversive stimulus	Take painkillers to end pain; fasten seat belt to end loud beeping

Negative reinforcement *strengthens* a response by *reducing or removing* something negative. Isaac's whining was *positively* reinforced, because Isaac got something desirable—his father's attention. His dad's response to the whining (taking Isaac to the mall) was negatively reinforced, because it ended an aversive event—Isaac's whining. Similarly, taking aspirin may relieve your headache, and pushing the snooze button will silence your annoying alarm. These welcome results provide negative reinforcement and increase the odds that you will repeat these behaviors. For drug addicts, the negative reinforcement of ending withdrawal pangs can be a compelling reason to resume using (Baker et al., 2004). Note that *negative reinforcement is not punishment.* (Some friendly advice: Repeat the last five words in your mind.) Rather, negative reinforcement *removes* a punishing (aversive) event. Think of negative reinforcement as something that provides relief—from that whining teenager, bad headache, or annoying alarm.

Sometimes negative and positive reinforcement coincide. Imagine a worried student who, after goofing off and getting a bad test grade, studies harder for the next test. This increased effort may be *negatively* reinforced by reduced anxiety, and *positively* reinforced by a better grade. Whether it works by reducing something aversive, or by giving something desirable, *reinforcement is any consequence that strengthens behavior.*

HI AND LOIS

negative reinforcement increasing behaviors by stopping or reducing negative stimuli. A negative reinforcer is any stimulus that, when *removed* after a response, strengthens the response. (*Note:* Negative reinforcement is not punishment.)

primary reinforcer an innately reinforcing stimulus, such as one that satisfies a biological need.

conditioned reinforcer a stimulus that gains its reinforcing power through its association with a primary reinforcer; also known as a *secondary reinforcer.*

PRIMARY AND CONDITIONED REINFORCERS

Getting food when hungry or having a painful headache go away is innately satisfying. These **primary reinforcers** are unlearned. **Conditioned reinforcers,** also called *secondary reinforcers,* get their power through learned association with primary reinforcers. If a rat in a Skinner box learns that a light reliably signals a food delivery, the rat will work to turn on the light. The light has become a conditioned reinforcer. Our lives are filled with conditioned reinforcers—money, good grades, a pleasant tone of voice—each of which has been linked with more basic rewards.

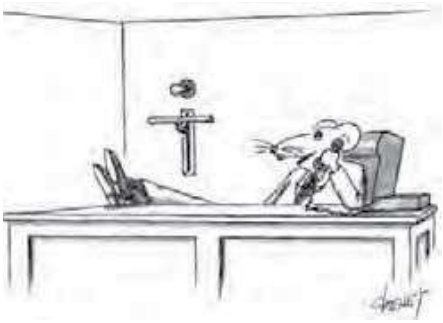
IMMEDIATE AND DELAYED REINFORCERS

Let's return to the imaginary shaping experiment in which you were conditioning a rat to press a bar. Before performing this "wanted" behavior, the hungry rat will engage in a sequence of "unwanted" behaviors—scratching, sniffing, and moving around. If you present

food immediately after any one of these behaviors, the rat will likely repeat that rewarded behavior. But what if the rat presses the bar while you are distracted, and you delay giving the reinforcer? If the delay lasts longer than about 30 seconds, the rat will not learn to press the bar. You will have reinforced other incidental behaviors—more sniffing and moving—that intervened after the bar press.

Unlike rats, humans do respond to delayed reinforcers: the paycheck at the end of the week, the good grade at the end of the term, the trophy at the end of the season. Indeed, to function effectively we must learn to delay gratification. In laboratory testing, some 4-year-olds show this ability. In choosing a candy, they prefer having a big one tomorrow to munching on a small one right now. Learning to control our impulses in order to achieve more valued rewards is a big step toward maturity (Logue, 1998a,b). No wonder children who make such choices have tended to become socially competent and high-achieving adults (Mischel et al., 1989).

To our detriment, small but immediate consequences (the enjoyment of late-night videos or texting, for example) are sometimes more alluring than big but delayed consequences (feeling alert tomorrow). For many teens, the immediate gratification of risky, unprotected sex in passionate moments prevails over the delayed gratifications of safe sex or saved sex. And for many people, the immediate rewards of today's gas-guzzling vehicles, air travel, and air conditioning prevail over the bigger future consequences of global climate change, rising seas, and extreme weather.



"Oh, not bad. The light comes on, I press the bar, they write me a check. How about you?"

Reinforcement Schedules

27-3 How do different reinforcement schedules affect behavior?

In most of our examples, the desired response has been reinforced every time it occurs. But **reinforcement schedules** vary. With **continuous reinforcement,** learning occurs rapidly, which makes this the best choice for mastering a behavior. But extinction also occurs rapidly. When reinforcement stops—when we stop delivering food after the rat presses the bar—the behavior soon stops. If a normally dependable candy machine fails to deliver a chocolate bar twice in a row, we stop putting money into it (although a week later we may exhibit spontaneous recovery by trying again).

Real life rarely provides continuous reinforcement. Salespeople do not make a sale with every pitch. But they persist because their efforts are occasionally rewarded. This persistence is typical with **partial (intermittent) reinforcement** schedules, in which responses are sometimes reinforced, sometimes not. Learning is slower to appear, but *resistance to extinction* is greater than with continuous reinforcement. Imagine a pigeon that has learned to peck a key to obtain food. If you gradually phase out the food delivery until it occurs only rarely, in no predictable pattern, the pigeon may peck 150,000 times without a reward (Skinner, 1953). Gambling machines and lottery tickets reward gamblers in much the same way—occasionally and unpredictably. And like pigeons, slot players keep trying, time and time again. With intermittent reinforcement, hope springs eternal.

Lesson for child caregivers: Partial reinforcement also works with children. *Occasionally* giving in to children's tantrums for the sake of peace and quiet intermittently reinforces the tantrums. This is the very best procedure for making a behavior persist.

Skinner (1961) and his collaborators compared four schedules of partial reinforcement. Some are rigidly fixed, some unpredictably variable.

Fixed-ratio schedules reinforce behavior after a set number of responses. Coffee shops may reward us with a free drink after every 10 purchased. In the laboratory, rats may be reinforced on a fixed ratio of, say, one food pellet for every 30 responses. Once conditioned, animals will pause only briefly after a reinforcer before returning to a high rate of responding (**FIGURE 27.3** on the next page).

reinforcement schedule a pattern that defines how often a desired response will be reinforced.

continuous reinforcement reinforcing the desired response every time it occurs.

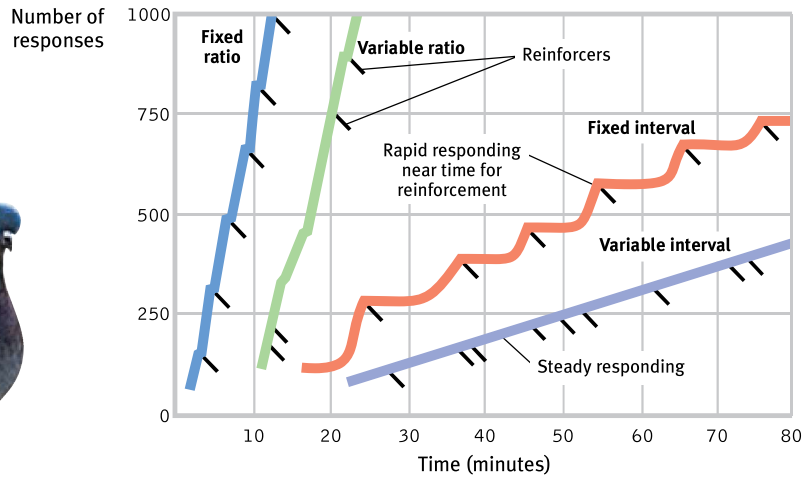
partial (intermittent) reinforcement reinforcing a response only part of the time; results in slower acquisition of a response but much greater resistance to extinction than does continuous reinforcement.

fixed-ratio schedule in operant conditioning, a reinforcement schedule that reinforces a response only after a specified number of responses.

"The charm of fishing is that it is the pursuit of what is elusive but attainable, a perpetual series of occasions for hope." -Scottish author John Buchan (1875–1940)

Figure 27.3
Intermittent reinforcement schedules
Skinner's laboratory pigeons produced these response patterns to each of four reinforcement schedules. (Reinforcers are indicated by diagonal marks.) For people, as for pigeons, reinforcement linked to number of responses (a *ratio schedule*) produces a higher response rate than reinforcement linked to amount of time elapsed (an *interval schedule*). But the predictability of the reward also matters. An unpredictable *(variable)* schedule produces more consistent responding than does a predictable *(fixed)* schedule.


Vitaly Titov & Maria Sidelnikova/Shutterstock



Variable-ratio schedules provide reinforcers after a seemingly unpredictable number of responses. This is what slot-machine players and fly-casting anglers experience—unpredictable reinforcement—and what makes gambling and fly fishing so hard to extinguish even when both are getting nothing for something. Because reinforcers increase as the number of responses increases, variable-ratio schedules produce high rates of responding.

Fixed-interval schedules reinforce the first response after a fixed time period. Animals on this type of schedule tend to respond more frequently as the anticipated time for reward draws near. People check more frequently for the mail as the delivery time approaches. A hungry child jiggles the Jell-O more often to see if it has set. Pigeons peck keys more rapidly as the time for reinforcement draws nearer. This produces a choppy stop-start pattern rather than a steady rate of response (see Figure 27.3).

Variable-interval schedules reinforce the first response after *varying* time intervals. Like the longed-for responses that finally reward persistence in rechecking e-mail or Facebook, variable-interval schedules tend to produce slow, steady responding. This makes sense, because there is no knowing when the waiting will be over (**TABLE 27.2**).

In general, response rates are higher when reinforcement is linked to the number of responses (a ratio schedule) rather than to time (an interval schedule). But responding is more consistent when reinforcement is unpredictable (a variable schedule) than when it is predictable (a fixed schedule). Animal behaviors differ, yet Skinner (1956) contended

AP® Exam Tip
The word "interval" in schedules of reinforcement means that an interval of time must pass before reinforcement. There is nothing the learner can do to shorten the interval. The word "ratio" refers to the ratio of responses to reinforcements. If the learner responds with greater frequency, there will be more reinforcements.

variable-ratio schedule
in operant conditioning, a reinforcement schedule that reinforces a response after an unpredictable number of responses.

fixed-interval schedule
in operant conditioning, a reinforcement schedule that reinforces a response only after a specified time has elapsed.

variable-interval schedule
in operant conditioning, a reinforcement schedule that reinforces a response at unpredictable time intervals.

Table 27.2 Schedules of Reinforcement

	Fixed	Variable
Ratio	*Every so many:* reinforcement after every *nth* behavior, such as buy 10 coffees, get 1 free, or pay per product unit produced	*After an unpredictable number:* reinforcement after a random number of behaviors, as when playing slot machines or fly casting
Interval	*Every so often:* reinforcement for behavior after a fixed time, such as Tuesday discount prices	*Unpredictably often:* reinforcement for behavior after a random amount of time, as in checking for a Facebook response

that the reinforcement principles of operant conditioning are universal. It matters little, he said, what response, what reinforcer, or what species you use. The effect of a given reinforcement schedule is pretty much the same: "Pigeon, rat, monkey, which is which? It doesn't matter. . . . Behavior shows astonishingly similar properties."

Punishment

27-4 How does punishment differ from negative reinforcement, and how does punishment affect behavior?

Reinforcement increases a behavior; **punishment** does the opposite. A *punisher* is any consequence that *decreases* the frequency of a preceding behavior (**TABLE 27.3**). Swift and sure punishers can powerfully restrain unwanted behavior. The rat that is shocked after touching a forbidden object and the child who is burned by touching a hot stove will learn not to repeat those behaviors. A dog that has learned to come running at the sound of an electric can opener will stop coming if its owner runs the machine to attract the dog and banish it to the basement.

Table 27.3 Ways to Decrease Behavior

Type of Punisher	Description	Examples
Positive punishment	Administer an aversive stimulus	Spray water on a barking dog; give a traffic ticket for speeding
Negative punishment	Withdraw a rewarding stimulus	Take away a teen's driving privileges; revoke a library card for nonpayment of fines

Criminal behavior, much of it impulsive, is also influenced more by swift and sure punishers than by the threat of severe sentences (Darley & Alter, 2011). Thus, when Arizona introduced an exceptionally harsh sentence for first-time drunk drivers, the drunk-driving rate changed very little. But when Kansas City police started patrolling a high crime area to increase the sureness and swiftness of punishment, that city's crime rate dropped dramatically.

How should we interpret the punishment studies in relation to parenting practices? Many psychologists and supporters of nonviolent parenting note four major drawbacks of physical punishment (Gershoff, 2002; Marshall, 2002).

1. *Punished behavior is suppressed, not forgotten. This temporary state may (negatively) reinforce parents' punishing behavior.* The child swears, the parent swats, the parent hears no more swearing and feels the punishment successfully stopped the behavior. No wonder spanking is a hit with so many U.S. parents of 3- and 4-year-olds—more than 9 in 10 of whom acknowledged spanking their children (Kazdin & Benjet, 2003).
2. *Punishment teaches discrimination among situations.* In operant conditioning, *discrimination* occurs when an organism learns that certain responses, but not others, will be reinforced. Did the punishment effectively end the child's swearing? Or did the child simply learn that it's not okay to swear around the house, though okay elsewhere?
3. *Punishment can teach fear.* In operant conditioning, *generalization* occurs when an organism's response to similar stimuli is also reinforced. A punished child may associate fear not only with the undesirable behavior but also with the person who delivered the punishment or the place it occurred. Thus, children may learn to fear a punishing teacher and try to avoid school, or may become more anxious (Gershoff et al., 2010). For such reasons, most European countries and most U.S. states now ban

Try This

Telemarketers are reinforced by which schedule? People checking the oven to see if the cookies are done are on which schedule? Airline frequent-flyer programs that offer a free flight after every 25,000 miles of travel use which reinforcement schedule?

ANSWERS: Telemarketers are reinforced on a variable-ratio schedule (after varying numbers of rings). Cookie checkers are reinforced on a fixed-interval schedule. Frequent-flyer programs use a fixed-ratio schedule.

AP® Exam Tip

Remember that *any kind of reinforcement* (positive, negative, primary, conditioned, immediate, delayed, continuous, or partial) encourages the behavior. *Any kind of punishment* discourages the behavior. Positive and negative do not refer to values—it's not that positive reinforcement (or punishment) is the good kind and negative is the bad. Think of positive and negative mathematically; a stimulus is added with positive reinforcement (or punishment) and a stimulus is subtracted with negative reinforcement (or punishment).

punishment an event that tends to *decrease* the behavior that it follows.

David Strickler/The Image Works

Children see, children do? Children who often experience physical punishment tend to display more aggression.

hitting children in schools and child-care institutions (www.stophitting.com). Thirty-three countries, including those in Scandinavia, further outlaw hitting by parents, providing children the same legal protection given to spouses.

4. *Physical punishment may increase aggression by modeling aggression as a way to cope with problems.* Studies find that spanked children are at increased risk for aggression (and depression and low self-esteem). We know, for example, that many aggressive delinquents and abusive parents come from abusive families (Straus & Gelles, 1980; Straus et al., 1997).

Some researchers note a problem. Well, *yes,* they say, physically punished children may be more aggressive, for the same reason that people who have undergone psychotherapy are more likely to suffer depression—because they had preexisting problems that triggered the treatments (Larzelere, 2000, 2004). Which is the chicken and which is the egg? Correlations don't hand us an answer.

If one adjusts for preexisting antisocial behavior, then an occasional single swat or two to misbehaving 2- to 6-year-olds looks more effective (Baumrind et al., 2002; Larzelere & Kuhn, 2005). That is especially so if two other conditions are met:

1. The swat is used only as a backup when milder disciplinary tactics, such as a time-out (removing them from reinforcing surroundings), fail.
2. The swat is combined with a generous dose of reasoning and reinforcing.

Other researchers remain unconvinced. After controlling for prior misbehavior, they report that more frequent spankings of young children predict future aggressiveness (Grogan-Kaylor, 2004; Taylor et al., 2010).

Parents of delinquent youths are often unaware of how to achieve desirable behaviors without screaming at or hitting their children (Patterson et al., 1982). Training programs can help transform dire threats ("Apologize right now or I'm taking that cell phone away!") into positive incentives ("You're welcome to have your phone back when you apologize."). Stop and think about it. Aren't many threats of punishment just as forceful, and perhaps more effective, when rephrased positively? Thus, "If you don't get your homework done, I'm not giving you money for a movie!" would better be phrased as . . . .

In classrooms, too, teachers can give feedback on papers by saying, "No, but try this . . ." and "Yes, that's it!" Such responses reduce unwanted behavior while reinforcing more desirable alternatives. Remember: *Punishment tells you what not to do; reinforcement tells you what to do.*

What punishment often teaches, said Skinner, is how to avoid it. Most psychologists now favor an emphasis on reinforcement.

B. F. Skinner "I am sometimes asked, 'Do you think of yourself as you think of the organisms you study?' The answer is yes. So far as I know, my behavior at any given moment has been nothing more than the product of my genetic endowment, my personal history, and the current setting" (1983).

Skinner's Legacy

27-5 Why did Skinner's ideas provoke controversy?

B. F. Skinner stirred a hornet's nest with his outspoken beliefs. He repeatedly insisted that external influences (not internal thoughts and feelings) shape behavior. And he urged people to use operant principles to influence others' behavior at school, work, and home. Knowing that behavior is shaped by its results, he said we should use rewards to evoke more desirable behavior.

Skinner's critics objected, saying that he dehumanized people by neglecting their personal freedom and by seeking to control their actions. Skinner's reply: External consequences already haphazardly control people's behavior. Why not administer those consequences toward human betterment? Wouldn't reinforcers be more humane than the punishments used in homes, schools, and prisons? And if it is humbling to think that our history has shaped us, doesn't this very idea also give us hope that we can shape our future?

Before You Move On

▶ ASK YOURSELF

Does your social media behavior (such as checking for new messages) make sense now that you've learned about the different kinds of reinforcement schedules?

▶ TEST YOURSELF

Fill in the three blanks below with one of the following terms: negative reinforcement (NR), positive punishment (PP), and negative punishment (NP). The first answer, positive reinforcement (PR) is provided for you.

Type of Stimulus	Give It	Take It Away
Desired (for example, a teen's use of the car):	1. PR	2.
Undesired/aversive (for example, an insult):	3.	4.

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

Module 27 Review

27-1 What is operant conditioning, and how is operant behavior reinforced and shaped?

- In *operant conditioning,* behaviors followed by reinforcers increase; those followed by punishers often decrease.
- Expanding on Edward Thorndike's *law of effect,* B. F. Skinner and others found that the behavior of rats or pigeons placed in an *operant chamber* (Skinner box) can be *shaped* by using reinforcers to guide closer and closer approximations of the desired behavior.

27-2 How do positive and negative reinforcement differ, and what are the basic types of reinforcers?

- *Reinforcement* is any consequence that strengthens behavior. *Positive reinforcement* adds a desirable stimulus to increase the frequency of a behavior. *Negative reinforcement* removes an aversive stimulus to increase the frequency of a behavior.
- *Primary reinforcers* (such as receiving food when hungry or having nausea end during an illness) are innately satisfying—no learning is required.
- *Conditioned* (or secondary) *reinforcers* (such as cash) are satisfying because we have learned to associate them with more basic rewards (such as the food or medicine we buy with them).
- Immediate reinforcers (such as a purchased treat) offer immediate payback; delayed reinforcers (such as a weekly paycheck) require the ability to delay gratification.

27-3 How do different reinforcement schedules affect behavior?

- A *reinforcement schedule* defines how often a response will be reinforced.
- In *continuous reinforcement* (reinforcing desired responses every time they occur), learning is rapid, but so is extinction if rewards cease. In *partial (intermittent) reinforcement* (reinforcing responses only sometimes), initial learning is slower, but the behavior is much more resistant to extinction.
- *Fixed-ratio schedules* reinforce behaviors after a set number of responses; *variable-ratio schedules,* after an unpredictable number.
- *Fixed-interval schedules* reinforce behaviors after set time periods; *variable-interval schedules,* after unpredictable time periods.

27-4 How does punishment differ from negative reinforcement, and how does punishment affect behavior?

- *Punishment* administers an undesirable consequence (such as spanking) or withdraws something desirable (such as taking away a favorite toy) in an attempt to decrease the frequency of a behavior (a child's disobedience).
- Negative reinforcement (taking an aspirin) removes an aversive stimulus (a headache). This desired consequence (freedom from pain) increases the likelihood that the behavior (taking aspirin to end pain) will be repeated.
- Punishment can have undesirable side effects, such as suppressing rather than changing unwanted behaviors; teaching aggression; creating fear; encouraging discrimination (so that the undesirable behavior appears when the punisher is not present); and fostering depression and low self-esteem.

27-5 Why did Skinner's ideas provoke controversy?

- Critics of Skinner's principles believed the approach dehumanized people by neglecting their personal freedom and seeking to control their actions. Skinner replied that people's actions are already controlled by external consequences, and that reinforcement is more humane than punishment as a means for controlling behavior.

Multiple-Choice Questions

1. What do we call the kind of learning in which behavior is strengthened if followed by a reinforcer?

a. Operant conditioning
b. Respondent behavior
c. Classical conditioning
d. Shaping
e. Punishment

2. Which of the following best describes a discriminative stimulus?

a. Something that elicits a response after association with a reinforcer
b. An innately reinforcing stimulus
c. Something that when removed increases the likelihood of the behavior
d. An event that decreases the behavior it follows
e. An amplified stimulus feeding back information to responses

3. Thorndike's principle that behaviors followed by favorable consequences become more likely is known as what?

a. Law of effect
b. Operant conditioning
c. Shaping
d. Respondent behavior
e. Discrimination

4. All of the following are examples of primary reinforcers except a

a. rat's food reward in a Skinner box.
b. cold drink on a hot day.
c. high score on an exam for which a student studied diligently.
d. hug from a loved one.
e. large meal following an extended time without food.

Practice FRQs

1. Mom is frustrated because 3-year-old Maya has started to spit frequently. She has decided to temporarily put away one of Maya's toys every time she spits. Mom is going to continue this until Maya has stopped spitting.

- Explain whether Mom's plan uses reinforcement or punishment.
- Explain whether Mom's plan is a positive or negative form of reinforcement or punishment.

Answer

1 point: The plan uses punishment, because it is designed to reduce the frequency of spitting.

1 point: This is negative punishment because toys are being taken away from Maya.

2. A business owner is considering different compensation plans for her sales force. Identify what schedule of reinforcement is reflected in each of the following plans, making sure you explain why each answer is correct:

- The owner will pay a $1,500 bonus each time a hundred units are sold.
- The owner will have a lottery each month. Each salesperson will get one lottery ticket for every one hundred units sold. The salesperson with the winning ticket will get $5,000.
- The owner will pay each salesperson a monthly salary that does not depend on units sold.

(3 points)