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

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.

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 an unconditioned response (UR).

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.

RETRIEVAL PRACTICE

- Why are habits, such as having something sweet with that cup of coffee, so hard to break?

ANSWER: Habits form when we repeat behaviors in a given context and, as a result, learn associations—often without our awareness. For example, we may have eaten a sweet pastry with a cup of coffee often enough to associate the flavor of the coffee with the treat, so that the cup of coffee alone just doesn't seem right anymore!

Classical Conditioning

7-2 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.

This view, which Watson called **behaviorism,** influenced North American psychology during the first half of the twentieth century. 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 sea slugs or 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

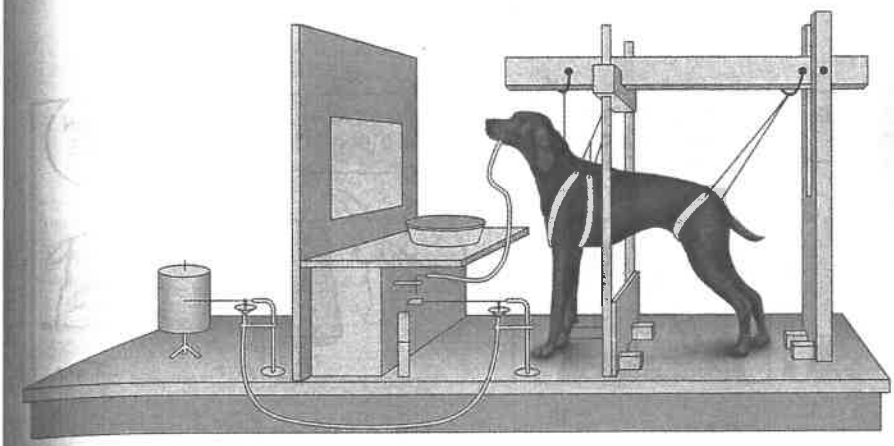
7-3 Who was Pavlov, and what are the basic components of classical conditioning?

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

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.

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 the food dish, or 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 fundamental 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 7.3**). From the



▼ FIGURE 7.3
Pavlov's device for recording salivation A tube in the dog's cheek collects saliva, which is measured in a cylinder outside the chamber.

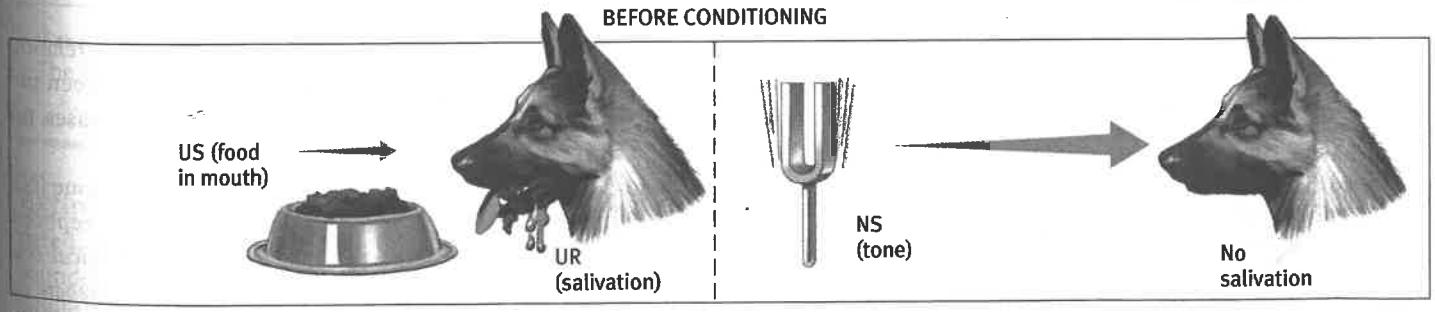
next room, they presented food—first by sliding in a food bowl, later by blowing meat powder into the dog's mouth at a precise moment. They then paired various **neutral stimuli (NS)**—events the dog could see or hear but didn't associate with food—with food in the dog's mouth. If a sight or sound regularly signaled the arrival of food, would the dog learn the link? If so, would it begin salivating in anticipation of the food?

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 does not learn to salivate in response to food in its mouth. Rather, food in the mouth automatically, *unconditionally*, triggers a dog's salivary reflex (**FIGURE 7.4**). Thus, Pavlov called the drooling an **unconditioned response (UR)**. And he called the food an **unconditioned stimulus (US)**.

1. The "buzzer" (English translation) was perhaps a small electric bell (Tully, 2003).

▼ FIGURE 7.4
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.



An unconditioned stimulus (US) produces an unconditioned response (UR).

A neutral stimulus (NS) produces no salivation response.

The US is repeatedly presented just after the NS.
The US continues to produce a UR.

The previously neutral stimulus alone now produces a conditioned response (CR), thereby becoming a conditioned stimulus (CS).

PEANUTS

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.*)

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.

Salivation in response to the tone, however, is learned. It is *conditional* upon the dog's associating the tone with the food. Thus, 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 salivation) is the **conditioned stimulus (CS).** Distinguishing these two kinds of stimuli and responses is easy: Conditioned = learned; *un*conditioned = *un*learned.

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.*

RETRIEVAL PRACTICE

- 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?

ANSWER: NS = tone before conditioning; US = air puff; UR = blink to air puff; CS = tone after conditioning; CR = blink to tone.

Acquisition

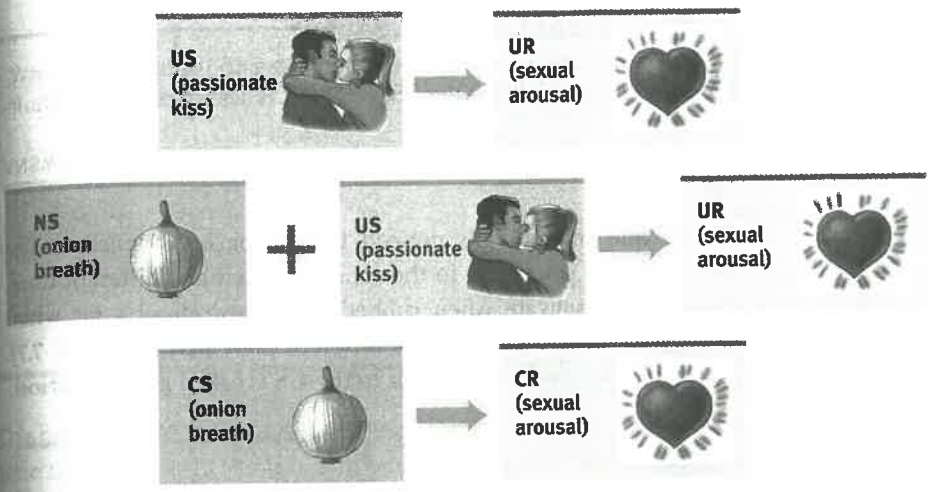
7-4 In classical conditioning, what are the processes of acquisition, extinction, spontaneous recovery, generalization, and discrimination?

To understand the **acquisition,** or initial learning, of the stimulus-response relationship, Pavlov and his associates wondered: 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).

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 a sexually 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). This capacity for classical conditioning gives the quail a reproductive edge.



▼ FIGURE 7.5
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!"

In humans, too, objects, smells, and sights associated with sexual pleasure—even a geometric figure in one experiment—can become conditioned stimuli for sexual arousal (Byrne, 1982; Hoffman, 2012). 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 7.5**). 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). Learning makes for yearning.

Through **higher-order conditioning,** a new NS can become a new CS without the presence of a US. 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 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.

Remember:
NS = Neutral Stimulus
US = Unconditioned Stimulus
UR = Unconditioned Response
CS = Conditioned Stimulus
CR = Conditioned Response

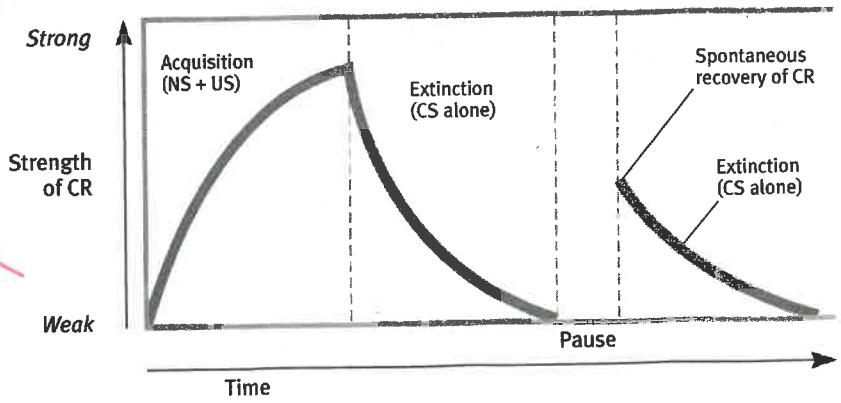
RETRIEVAL PRACTICE

- If the aroma of a baking cake sets your mouth to watering, what is the US? The CS? The CR?

ANSWER: The cake (and its taste) are the US. The associated aroma is the CS. Salivation to the aroma is the CR.

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,** which is the diminished response 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 7.6**). 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.

▼ FIGURE 7.6
Idealized curve of acquisition, extinction, and spontaneous recovery The rising curve shows the CR rapidly growing stronger as the NS becomes a CS due to repeated pairing with the US *(acquisition).* The CR then weakens rapidly as the CS is presented alone *(extinction).* After a pause, the (weakened) CR reappears *(spontaneous recovery).*



Applications of Classical Conditioning

7-6 What have been some applications of Pavlov's work to human health and well-being? How did Watson apply Pavlov's principles to learned fears?

Other chapters 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. Sleuthing by Russell Powell and his colleagues (2014) found a well-matched child of one of the hospital's wet nurses. The child, William Albert Barger, went by Albert B.—precisely the name used by Watson and Rayner. This Albert lived to 2007. He was an easygoing person, though, perhaps coincidentally, he had an aversion to dogs. Albert died without ever knowing of his early life in a hospital residence or his role in psychology's history.

People also wondered what became of Watson. After losing his Johns Hopkins professorship over an affair with Raynor (his graduate student, 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).

The treatment of Little Albert would be unacceptable by today's ethical standards. Also, some psychologists 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 entering 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 airline 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

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."

would be sucked down in three seconds.) In Chapter 16 we will see more examples of how psychologists use behavioral techniques to treat emotional disorders and promote personal growth.

RETRIEVAL PRACTICE

- 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?

Archives of the History of American Psychology, The Center for the History of Psychology, The University of Akron

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

REVIEW Basic Learning Concepts and Classical Conditioning

LEARNING OBJECTIVES

RETRIEVAL PRACTICE Take a moment to answer each of these Learning Objective Questions (repeated here from within this section). Then turn to Appendix C, Complete Chapter Reviews, to check your answers. Research suggests that trying to answer these questions on your own will improve your long-term retention (McDaniel et al., 2009).

7-1 What is *learning,* and what are some basic forms of learning?

7-2 What was behaviorism's view of learning?

7-3 Who was Pavlov, and what are the basic components of classical conditioning?

7-4 In classical conditioning, what are the processes of acquisition, extinction, spontaneous recovery, generalization, and discrimination?

7-5 Why does Pavlov's work remain so important?

7-6 What have been some applications of Pavlov's work to human health and well-being? How did Watson apply these principles to learned fears?

TERMS AND CONCEPTS TO REMEMBER

RETRIEVAL PRACTICE Test yourself on these terms by trying to write down the definition before flipping back to the page number referenced to check your answer.

learning, p. 280
associative learning, p. 281
stimulus, p. 281
respondent behavior, p. 281
operant behavior, p. 281
cognitive learning, p. 282
classical conditioning, p. 282
behaviorism, p. 282
neutral stimulus (NS), p. 283
unconditioned response (UR), p. 283
unconditioned stimulus (US), p. 283
conditioned response (CR), p. 284
conditioned stimulus (CS), p. 284
acquisition, p. 284
higher-order conditioning, p. 285
extinction, p. 285
spontaneous recovery, p. 285
generalization, p. 286
discrimination, p. 287

Use LearningCurve to create your personalized study plan, which will direct you to the resources that will help you most in LaunchPad.

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.

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.

Operant Conditioning

7-7 What is operant conditioning?

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 differences are 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 punishments often decrease. Behavior that *operates* on the environment to produce rewarding or punishing stimuli is called *operant behavior.*

RETRIEVAL PRACTICE

- With _____ conditioning, we learn associations between events we do not control. With _____ conditioning, we learn associations between our behavior and resulting events.

ANSWERS: classical; operant

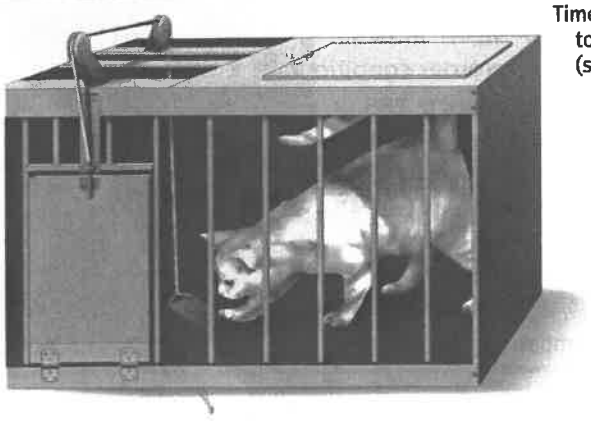
Skinner's Experiments

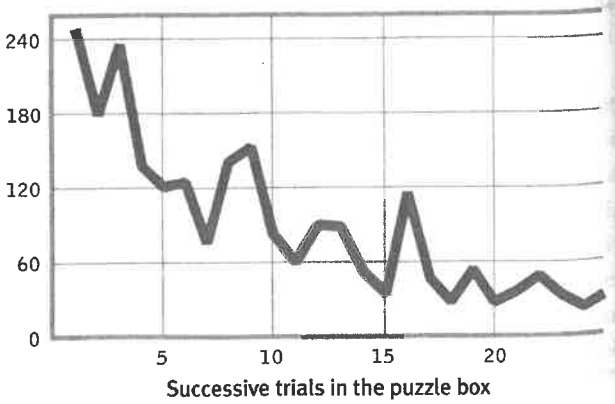
7-8 Who was Skinner, and how is operant behavior reinforced and shaped?

B. F. Skinner (1904–1990) was a college English major and 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 behavior is likely to recur (**FIGURE 7.9**), and punished behavior is less likely to recur. Using Thorndike's law of effect as a starting point, Skinner developed a behavioral technology that revealed principles of *behavior control.* By shaping pigeons' natural walking and pecking behaviors, for example, Skinner was able to teach them 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.

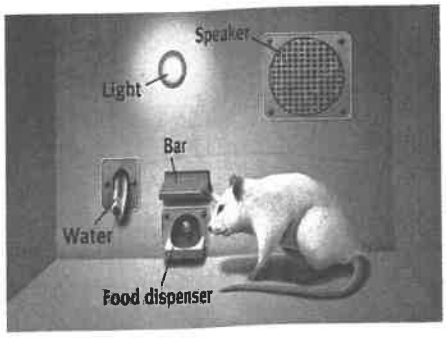
For his pioneering studies, Skinner designed an **operant chamber,** popularly known as a *Skinner box* (**FIGURE 7.10**). The box has a bar (a lever) that an animal presses—or a

▼ FIGURE 7.9
Cat in a puzzle box Thorndike used a fish reward to entice cats to find their way out of a puzzle box (left) through a series of maneuvers. The cats' performance tended to improve with successive trials (right), illustrating Thorndike's *law of effect.* (Adapted from Thorndike, 1898.)





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 other 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.



▼ FIGURE 7.10
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.

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 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).

Skinner noted that we continually reinforce and shape others' everyday behaviors, though we may not mean to do so. Billy's whining annoys his parents, for example, but consider how they typically respond:

Billy: Could you tie my shoes?
Father: (Continues reading paper.)
Billy: Dad, I need my shoes tied.
Father: Uh, yeah, just a minute.
Billy: DAAAAD! TIE MY SHOES!
Father: How many times have I told you not to whine? Now, which shoe do we do first?

Billy'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—Billy's whining.


Will Burgess/Reuters /Landov

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).


Antonia Brune, Valentine Photography

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!

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 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).

Types of Reinforcers

7-9 How do positive and negative reinforcement differ, and what are the basic types of reinforcers?

Until now, we've mainly been discussing **positive reinforcement,** which strengthens responding by *presenting* a typically pleasurable stimulus after a response. But, as we saw in the whining Billy story, there are *two* basic kinds of reinforcement (**TABLE 7.1**). **Negative reinforcement** strengthens a response by *reducing or removing* something negative. Billy's whining was *positively* reinforced, because Billy got something desirable—his father's attention. His dad's response to the whining (tying Billy's shoes) was *negatively* reinforced, because it ended an aversive event—Billy's whining. Similarly, taking aspirin may relieve your headache, and hitting snooze 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 italicized words in your mind.) Rather, negative reinforcement—psychology's most misunderstood concept—*removes* a punishing (aversive) event. Think of negative reinforcement as something that provides relief—from that whining child, bad headache, or annoying alarm.

▼ TABLE 7.1
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 seatbelt to end loud beeping.

RETRIEVAL PRACTICE

- How is operant conditioning at work in this cartoon?

ANSWER: The baby negatively reinforces her parents when she stops crying once they grant her wish. Her parents positively reinforce her cries by letting her sleep with them.

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

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.*

Sometimes negative and positive reinforcement coincide. Imagine a worried student who, after goofing off and getting a bad exam grade, studies harder for the next exam. This increased effort may be *negatively* reinforced by reduced anxiety, and *positively* reinforced by a better grade. We reap the rewards of escaping the aversive stimulus, which increases the chances that we will repeat our behavior. The point to remember: Whether it works by reducing something aversive, or by providing something desirable, *reinforcement is any consequence that strengthens behavior.*

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

▼ TABLE 7.2
Schedules of Reinforcement

	Fixed	Variable
Ratio	*Every so many:* reinforcement after every *nth* behavior, such as buy 10 coffees, get 1 free, or pay workers per product unit produced	*After an unpredictable number:* reinforcement after a random number of behaviors, as when playing slot machines or fly fishing
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 when checking for a Facebook response

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."

RETRIEVAL PRACTICE

- 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 are using which reinforcement schedule?

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

Punishment

7-11 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 7.3). 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 then banish it to the basement. Children's compliance often increases after a reprimand and a "time out" punishment (Owen et al., 2012).

Criminal behavior, much of it impulsive, is also influenced more by swift and sure punishers than by the threat of severe sentences (Darley & Alter, 2012). 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.

▼ TABLE 7.3
Ways to Decrease Behavior

Type of Punisher	Description	Examples
Positive punishment	Administer something that's undesired.	Spray water on a barking dog; give a traffic ticket for speeding.
Negative punishment	End something that's desired.	Take away a misbehaving teen's driving privileges; revoke a library card for nonpayment of fines.

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

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.

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

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 while it's not okay to swear around the house, it's okay to swear 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 where 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 hitting children in schools and child-care institutions (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 (MacKenzie et al., 2013). 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 (Ferguson, 2013; 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 children 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, hitting, or threatening their children with punishment (Patterson et al., 1982). Training programs can help transform dire threats ("You clean up your room this minute or no dinner!") into positive incentives ("You're welcome at the dinner table after you get your room cleaned up"). 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, there'll be no car" 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.* Thus, punishment trains a particular sort of morality—one focused on prohibition (what *not* to do) rather than positive obligations (Sheikh & Janoff-Bultman, 2013).

What punishment often teaches, said Skinner, is how to avoid it. Most psychologists now favor an emphasis on reinforcement: *Notice people doing something right and affirm them for it.*

RETRIEVAL PRACTICE

- Fill in the three blanks below with one of the following terms: positive reinforcement (PR), negative reinforcement (NR), positive punishment (PP), and negative punishment (NP). We have provided the first answer (PR) 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: 1. PR (positive reinforcement); 2. NP (negative punishment); 3. PP (positive punishment); 4. NR (negative reinforcement)

Skinner's Legacy

7-12 Why did Skinner's ideas provoke controversy, and how might his operant conditioning principles be applied at school, in sports, at work, and at home?

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 argued that 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? In such ways, and through his ideas for positively reinforcing character strengths, Skinner actually anticipated some of today's positive psychology (Adams, 2012).

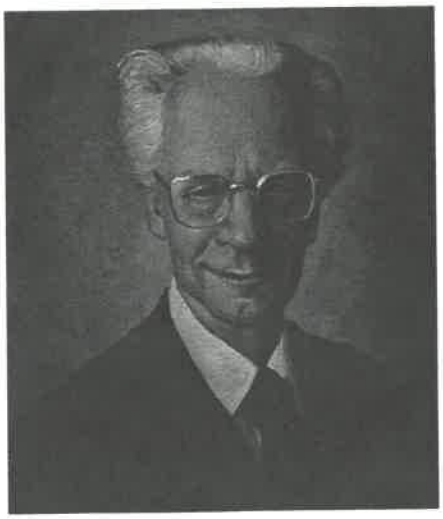
LaunchPad To review and experience simulations of operant conditioning, visit LaunchPad's *PsychSim 6: Operant Conditioning* and also *Shaping*.

Applications of Operant Conditioning

In later chapters, we will see how psychologists apply operant conditioning principles to help people moderate high blood pressure or gain social skills. Reinforcement technologies are also at work in schools, sports, workplaces, and homes, and these principles can support our self-improvement as well (Flora, 2004).

At School A generation ago, Skinner envisioned a day when teaching machines and textbooks would shape learning in small steps, immediately reinforcing correct responses. He believed such machines and texts would revolutionize education and free teachers to focus on each student's special needs.

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).



watch it increase. When children misbehave or are defiant, don't yell at them or hit them. Simply explain the misbehavior and give them a time-out.

Finally, we can use operant conditioning in our own lives. To reinforce your own desired behaviors (perhaps to improve your study habits) and extinguish the undesired ones (to stop smoking, for example), psychologists suggest taking these steps:

1. *State a realistic goal in measurable terms.* You might, for example, aim to boost your study time by an hour a day.
2. *Decide how, when, and where you will work toward your goal.* Take time to plan. Those who specify how they will implement goals more often fulfill them (Gollwitzer & Oettingen, 2012).
3. *Monitor how often you engage in your desired behavior.* You might log your current study time, noting under what conditions you do and don't study. (When I [DM] began writing textbooks, I logged how I spent my time each day and was amazed to discover how much time I was wasting. I [ND] experienced a similar rude awakening when I started tracking my daily writing hours.)
4. *Reinforce the desired behavior.* To increase your study time, give yourself a reward (a snack or some activity you enjoy) only after you finish your extra hour of study. Agree with your friends that you will join them for weekend activities only if you have met your realistic weekly studying goal.
5. *Reduce the rewards gradually.* As your new behaviors become more habitual, give yourself a mental pat on the back instead of a cookie.

"I wrote another five hundred words. Can I have another cookie?"

LaunchPad

HOW WOULD YOU KNOW?

Conditioning principles may also be applied in clinical settings. Explore some of these applications in LaunchPad's *How Would You Know If People Can Learn to Reduce Anxiety?*

Contrasting Classical and Operant Conditioning

7-13 How does operant conditioning differ from classical conditioning?

Both classical and operant conditioning are forms of *associative learning*. Both involve *acquisition, extinction, spontaneous recovery, generalization,* and *discrimination*. But these two forms of learning also differ. Through classical (Pavlovian) conditioning, we associate different stimuli we do not control, and we respond automatically (*respondent behaviors*) (**TABLE 7.4**). Through operant conditioning, we associate our own behaviors—which act on our environment to produce rewarding or punishing stimuli (*operant behaviors*)—with their consequences.

As we shall see next, our biology and cognitive processes influence both classical and operant conditioning.

"O! This learning, what a thing it is."

William Shakespeare, *The Taming of the Shrew*, 1597

▼ TABLE 7.4
Comparison of Classical and Operant Conditioning

	Classical Conditioning	Operant Conditioning
Basic idea	Organism associates events.	Organism associates behavior and resulting events.
Response	Involuntary, automatic.	Voluntary, operates on environment.
Acquisition	Associating events; NS is paired with US and becomes CS.	Associating response with a consequence (reinforcer or punisher).
Extinction	CR decreases when CS is repeatedly presented alone.	Responding decreases when reinforcement stops.
Spontaneous recovery	The reappearance, after a rest period, of an extinguished CR.	The reappearance, after a rest period, of an extinguished response.
Generalization	The tendency to respond to stimuli similar to the CS.	Organism's response to similar stimuli is also reinforced.
Discrimination	The learned ability to distinguish between a CS and other stimuli that do not signal a US.	Organism learns that certain responses, but not others, will be reinforced.