

Learning: Principles and Applications



PSYCHOLOGY
Online

Chapter Overview

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PSYCHOLOGY JOURNAL

Recall a situation in which you taught another person a skill or how to do a task. Write a brief account about it in your journal. Make sure to include a description of how reinforcement, punishment, or modeling was part of your teaching strategy. ■

Classical Conditioning

Reader's Guide

■ Main Idea

People acquire certain behaviors through classical conditioning, a learning procedure in which associations are made between a neutral stimulus and an unconditioned stimulus.

■ Vocabulary

- classical conditioning
- neutral stimulus
- unconditioned stimulus (US)
- unconditioned response (UR)
- conditioned stimulus (CS)
- conditioned response (CR)
- generalization
- discrimination
- extinction

■ Objectives

- Describe the principles of classical conditioning.
- Outline the techniques of classical conditioning.

EXPLORING PSYCHOLOGY

Which Pen Would You Choose?

The researchers placed the participants in a room. In this room the participants first viewed purple pens. As the participants sat staring at the purple pens, pleasant music played in the background. Then the music stopped, and the purple pens were taken away. Suddenly green pens appeared. As the participants sat staring at the green pens, they heard unpleasant music in the background. Later, the researchers offered the pens to the participants. The participants could pick a purple or green pen. The participants overwhelmingly chose purple pens. Why?

—adapted from *The Story of Psychology* by Morton Hunt, 1993

Why did the participants choose purple pens over green in the experiment above? This experiment took place in 1982 and was based on a principle that is widely used today in television commercials. Pairing a product with pleasant sensations motivates consumers to make a choice without an awareness of why they made that choice.

The Russian physiologist Ivan Pavlov called what was taking place in similar situations *conditioning*. In **classical conditioning**, a person's or animal's old response becomes attached to a new stimulus. This is one example of learning. What is learning? *Learning* is a relatively permanent change in a behavioral tendency that results from experience.

classical conditioning: a learning procedure in which associations are made between a neutral stimulus and an unconditioned stimulus

Pavlov's discovery of this type of learning—the principle of classical conditioning—was accidental. Around the turn of the twentieth century, Pavlov had been studying the process of digestion. Pavlov wanted to understand how a dog's stomach prepares to digest food when something is placed in its mouth. Then he noticed that the mere sight or smell of food was enough to start a hungry dog salivating. Pavlov became fascinated with how the dog anticipated the food and how salivation occurred before the food was presented, and he decided to investigate.

CLASSICAL CONDITIONING

Pavlov began his experiments by ringing a tuning fork and then immediately placing some meat powder on the dog's tongue. He chose the tuning fork because it was a **neutral stimulus**—that is, one that had nothing to do with the response to meat (salivation) prior to conditioning. After only a few times, the dog started salivating as soon as it heard the sound, even if the food was not placed in its mouth (see Figure 9.1). Pavlov demonstrated that a neutral stimulus (here, tuning fork or bell's ring) can cause a formerly unrelated response. This occurs if it is presented regularly just before the stimulus (here, food) that normally brings about that response (here, salivation).

Pavlov used the term *unconditioned* to refer to stimuli and to the automatic, involuntary responses they caused. Such responses include blushing, shivering, being startled, or salivating. In the experiment, food was the **unconditioned stimulus (US)**—an event that leads to a certain, predictable response usually without any previous training. Food normally causes salivation. A dog does not have to be taught to salivate when it smells meat. The salivation is an **unconditioned response (UR)**—a reaction that occurs naturally and automatically when the unconditioned stimulus is presented; in other words, a reflex.

Under normal conditions, the sound of a tuning fork would not cause salivation. The dog had to be taught, or conditioned, to associate this sound with food. An ordinarily neutral event that, after training, leads to a response such as salivation is termed a **conditioned stimulus (CS)**. The salivation it causes is a **conditioned response (CR)**. A conditioned response is learned. A wide variety of events may serve as conditioned stimuli for salivation—the sight of food, an experimenter entering the room, the sound of a tone, or a flash of light. A number of different reflex responses that occur automatically following an unconditioned stimulus (US) can be conditioned to occur following the correct conditioned stimulus (CS).

GENERAL PRINCIPLES OF CLASSICAL CONDITIONING

Classical conditioning helps animals and humans adapt to the environment. It also helps humans and animals avoid danger. Psychologists have investigated why and in what circumstances classical conditioning occurs, leading to a greater understanding of the principles of classical conditioning.

neutral stimulus: a stimulus that does not initially elicit any part of an unconditioned response

unconditioned stimulus (US): an event that elicits a certain predictable response typically without previous training

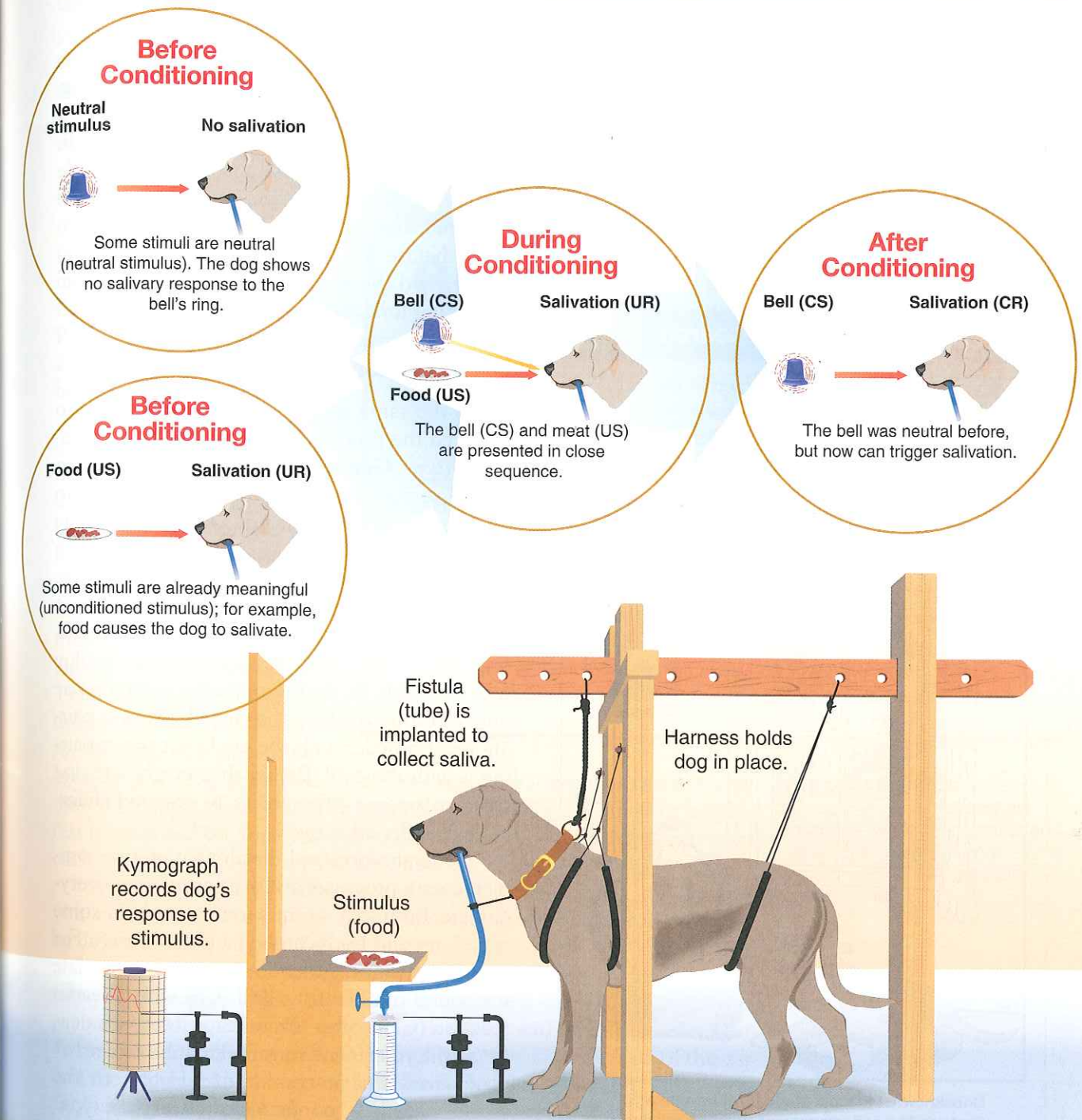
unconditioned response (UR): an organism's automatic (or natural) reaction to a stimulus

conditioned stimulus (CS): a once-neutral event that elicits a given response after a period of training in which it has been paired with (occurred just before) an unconditioned stimulus

conditioned response (CR): the learned reaction to a conditioned stimulus

Figure 9.1 Classical Conditioning Experiment

Pavlov's students used this apparatus. The tube leading from the dog's mouth allowed saliva to be measured and recorded on the kymograph. *What was the point of this experiment?*



Acquisition

Acquisition of a classically conditioned response generally occurs gradually. With each pairing of the conditioned stimulus (CS) and the unconditioned stimulus (US), the conditioned response (CR)—or learned response—is strengthened. In Pavlov's experiment, the more frequently the tuning fork was paired with the food, the more often the tone brought about salivation—the conditioned response.

The timing of the association between the conditioned stimulus (the tone) and the unconditioned stimulus (food) also influences learning. Pavlov tried several different conditioning procedures in which he varied the time between presenting the conditioned stimulus and the unconditioned stimulus. He found that classical conditioning was most reliable and effective when the conditioned stimulus was presented just before the unconditioned stimulus. He found that presenting the conditioned stimulus (CS) about half a second before the unconditioned stimulus (US) would yield the strongest associations between the tuning fork and the meat.

generalization: responding similarly to a range of similar stimuli

discrimination: the ability to respond differently to similar but distinct stimuli

Figure 9.2 Pavlov's Research

The name of Pavlov is well-known in the field of psychology because of his pioneering research. *In this cartoonist's depiction, what is the neutral stimulus? The CR?*



Generalization and Discrimination

In the same set of experiments, Pavlov also explored the processes of *generalization* and *discrimination*. **Generalization** occurs when an animal responds to a second stimulus similar to the original CS without prior training with the second stimulus. When Pavlov conditioned a dog to salivate at the sight of a circle (the CS), he found that the dog would salivate when it saw an oval as well. The dog had generalized its response to include a similar stimulus. Pavlov was later able to do the opposite, teaching the dog to respond only to the circle by always pairing meat powder with the circle but never pairing it with the oval. Pavlov thus taught the dog **discrimination**—the ability to respond differently to different stimuli.

Generalization and discrimination are complementary processes and are part of your everyday life. Both may occur spontaneously in some situations, and both can be taught in others. For example, assume a friend has come to associate the sound of a dentist's drill (CS) with a fearful reaction (CR). After several exposures to a dentist's drill, your friend may find that he or she has generalized this uncomfortable feeling to the sound of other, nondental drills. Later, your friend may learn to discriminate between the sound of a dentist's drill and other drills.

Extinction and Spontaneous Recovery

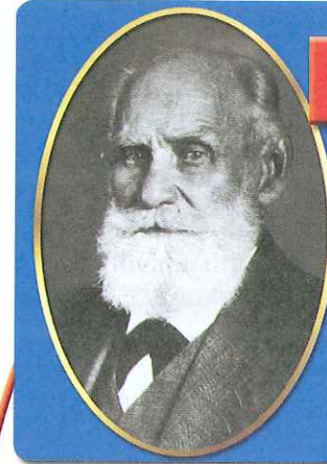
A classically conditioned response, like any other behavior, is subject to change. Pavlov discovered that if he stopped presenting food after the sound of the tuning fork, the sound gradually lost its effect on the dog. After he repeatedly struck the tuning fork without giving food, the dog no longer associated the sound with the arrival of food—the sound of the tuning fork no longer caused the salivation response. Pavlov called this effect **extinction** because the CR had gradually died out.

Even though a classically conditioned response may be extinguished, this does not mean that the CR has been completely unlearned. If a rest period is given following extinction, the CR may reappear when the CS is presented again but not followed by a US. This *spontaneous recovery* does not bring the CR back to original strength, how-

ever. Pavlov's dogs produced much less saliva during spontaneous recovery than they did at the end of their original conditioning. Alternating lengthy rest periods and the tone without food caused more rapid loss of salivation each time and less recovery the next time the CS was presented.

A good example of extinction and spontaneous recovery can occur if you are involved in a car accident. Following the accident it may at first be difficult to drive again. You might even find it difficult to open the door and get into the car. As you approach the car, your hands begin to shake and your knees get shaky as well. Your heartbeat even increases as you get nearer. After a few days, opening the door and getting into the car do not bother you as much. Several months go by and the fears of the car and the accident have been extinguished. One day, several months later, as you begin to approach the car, your heart begins to race and your knees and hands begin to shake. You have had a spontaneous recovery of the fear reaction.

Profiles In Psychology



Ivan Petrovich Pavlov

1849–1936

"While you are experimenting, do not remain content with the surface of things. Don't become a mere recorder of facts, but try to penetrate the mystery of their origin."

Born in central Russia, Pavlov abandoned his family's hopes that he would become a priest, and instead pursued science. After receiving his doctoral degree from the University of St. Petersburg in 1897, he began performing his own research into digestion and blood circulation. The work that made Pavlov famous actually began as a study of digestion, for which he won the Nobel Prize in 1904. Pavlov discovered that salivation and the action of the stomach were closely linked to reflexes in the autonomic nervous system. By studying conditioned reflexes, it became possible to examine human behavior objectively, instead of resorting to subjective methods.

Pavlov distrusted the new science of psychiatry. He did think, though, that conditioned reflexes could explain the behavior of psychotic people. He believed that those who withdrew from the world may associate all stimuli with possible injury or threat.

extinction: the gradual disappearance of a conditioned response when the conditioned stimulus is repeatedly presented without the unconditioned stimulus

CLASSICAL CONDITIONING AND HUMAN BEHAVIOR

John B. Watson and Rosalie Rayner (1920) used conditioning on a human infant in the case of Little Albert (see Case Studies, page 249). Watson questioned the role that conditioning played in the development of emotional responses in children. He and Rayner attempted to condition an 11-month-old infant named Albert to fear laboratory rats. At first Albert happily played with the rats. When Watson struck a steel bar with a hammer to produce a loud sound, Albert began to display a fear response. Eventually Albert showed fear each time he saw the rat even though the loud sound was not repeated. Although this demonstration is now viewed as unethical (because the researchers taught Little Albert to fear things that he previously had no fear of), it provided evidence that emotional responses can be classically conditioned in humans. In this case the US is the loud noise, the UR is fear, the CS is the rat, and the CR is fear.

Did You Know?

Classical Conditioning Have you ever noticed how movie directors use music in their movies? Did you ever hear a song and then think about either the movie it was from or the person you were with when you saw the movie? If so, you experienced classical conditioning. The music had become a “signal” that triggers memories and emotions. A conditioned emotion, such as fear, is a very difficult response to extinguish. It may trigger physical, cognitive, and emotional reactions.

Using the principle of classical conditioning, O. Hobart and Mollie Mowrer (1938) discovered a practical solution to the problem of bed-wetting. One reason bed-wetting occurs is that children do not wake up during the night to body signals that they have a full bladder. The Mowrers developed a device known as the *bell and pad*. It consists of two metallic sheets perforated with small holes and wired to a battery-run alarm. The thin, metal sheets—wrapped in insulation or padding—are placed under the child’s bedsheets. When the sleeping child moistens the sheet with the first drops of urine, the circuit closes, causing the alarm to go off and wake the child. The child can then use the bathroom.

The alarm is the unconditioned stimulus that produces the unconditioned response of waking up. The sensation of a full bladder is the conditioned stimulus that, before conditioning, did not produce wakefulness. After several pairings of the full bladder (CS) and the alarm (US), the child is able to awaken to the sensation of a full bladder without the help of the alarm. This technique has proven to be a very effective way of treating bed-wetting problems.

Taste Aversions

Suppose you go to a fancy restaurant. You decide to try an expensive appetizer you have never eaten, for instance, snails. Then suppose that, after dinner, you go to a concert and become violently ill. You will probably develop a taste aversion; you may never be able to look at another snail without becoming at least a little nauseated.

Your nausea reaction to snails is another example of classical conditioning. What makes this type of conditioning interesting to learning theorists is that when people or other animals become ill, they seem to decide, “It must have been something I ate,” even if they have not eaten

 **Reading Check**
How do people develop taste aversions?

Figure 9.3 Examples of Common Conditioned Responses

If you have pets and feed them canned food, what happens when you use the can opener? The animals may come running even when you are opening a can of peas. *Why do you feel distress at the mere sight of flashing police lights?*

CS	CR	US	UR
Dentist/ sound of drill	Tension	Drill	Tension
Product (soda pop)	Favorable feeling	Catchy jingle or slogan	Favorable feeling
Flashing police car lights	Distress	Speeding ticket	Distress

for several hours. It is unlikely that the concert hall in which you were sick will become the conditioned stimulus, nor will other stimuli from the restaurant—the wallpaper pattern or the type of china used. What is more, psychologists can even predict which part of your meal will be the CS—you will probably blame a new food. Thus, if you get sick after a meal of salad, steak, and snails, you will probably learn to hate snails, even if they are really not the cause of your illness.

John Garcia and R.A. Koelling (1966) first demonstrated this phenomenon with rats. The animals were placed in a cage with a tube containing flavored water. Whenever a rat took a drink, lights flashed and clicks sounded. Then, some of the rats were given an electric shock after they drank. All these rats showed traditional classical conditioning—the lights and the sounds became conditioned stimuli, and the rats tried to avoid them in order to avoid a shock. The other rats were not shocked but were injected with a drug that made them sick after they drank and the lights and sounds occurred. These rats developed an aversion not to the lights or the sounds but only to the taste of the flavored water.

This special relationship between food and illness was used in a study that made coyotes avoid sheep by giving them a drug to make them sick when they ate sheep (Gustavson et al., 1974). This application is important because sheep farmers in the western United States would like to eliminate the coyotes that threaten their flocks, while naturalists are opposed to killing the coyotes. If coyotes could be trained to hate the taste of sheep, they would rely on other foods and thus learn to coexist peacefully with sheep.

In summary, classical conditioning helps animals and humans predict what is going to happen. It provides information that may be helpful to their survival. Learning associated with classical conditioning may aid animals in finding food or help humans avoid pain or injury. For example, parents may condition an infant to avoid a danger such as electrical outlets by shouting “NO!” and startling the infant each time he approaches an outlet. The infant fears the shouts of the parents, and eventually the infant may fear the outlet even when the parents are not there.



Student Web Activity
Visit the *Understanding Psychology* Web site at glencoe.com and click on **Chapter 9—Student Web Activities** for an activity about learning.

Figure 9.4

Classical Conditioning vs. Operant Conditioning

Classical conditioning and operant conditioning both involve the establishment of relationships between two events. Classical conditioning and operant conditioning, though, use very different procedures to reach their goals. **What role does the learner's environment play in each type of conditioning?**

Classical Conditioning

1. Always a specific stimulus (US) that elicits the desired response
2. US does not depend upon learner's response
3. Environment elicits response from learner

Operant Conditioning

1. No identifiable stimulus; learner must first respond, then behavior is reinforced
2. Reinforcement depends upon learner's behavior
3. Learner actively operates on its environment

Classical conditioning is an example of a behaviorist theory. *Behaviorism* is the attempt to understand behavior in terms of relationships between observable stimuli and observable responses. *Behaviorists* are psychologists who study only those behaviors that they can observe and measure. Behaviorists are not concerned with unobservable mental processes. They emphasize actions instead of thoughts. We will discuss another behaviorist learning theory, operant conditioning, in the next section. Classical conditioning is a process by which a stimulus that previously did not elicit a response comes to elicit a response after it is paired with a stimulus that naturally elicits a response. In contrast, operant conditioning is a process by which the consequences of a response affect the likelihood that the response will occur again (see Figure 9.4).

SECTION I

Assessment

1. **Review the Vocabulary** What is the difference between a neutral stimulus and an unconditioned stimulus?
2. **Visualize the Main Idea** In a graphic organizer similar to the one below, describe the process of classical conditioning.
3. **Recall Information** How are generalization and discrimination related to classical conditioning?
4. **Think Critically** Under what conditions might a conditioned response become extinct?



5. **Application Activity** You have a friend who inhales noisily when standing next to you and then puffs air into your eye. You find that you now blink when you hear your friend inhale. Identify and describe the neutral stimulus, the US, UR, CS, and CR in your behavior.

Case Studies

The Case of Little Albert

Period of Study: Winter, 1919–1920

Introduction: John B. Watson and Rosalie Rayner showed how conditioning could be used on a human infant. The study led to ethical questions on research with humans. From such research, Watson concluded that there are only a few instinctive reflexes in humans, among them, sucking, reaching, and grasping. In addition, infants have three innate emotional responses to stimuli: fear at hearing a loud sound or at suddenly being dropped; rage when arm or head movements are forcibly restrained; and love when stroked, rocked, gently patted, and the like.



was struck, Albert began to whimper. The noise, the unconditioned stimulus, brought about a naturally unconditioned response, fear. After only a few such pairings, the rat became a *conditioned stimulus* that elicited a *conditioned response*, fear.

Five days after Watson and Rayner conditioned Albert to fear rats, they presented him with blocks, a rabbit, a rat, and a dog, each alone. They also showed him a number of other stimuli, including a Santa Claus mask. Albert reacted fearfully to all but the blocks. His conditioned fear response generalized to include the rabbit and all of the white furry objects he was shown, but not to any dissimilar toys.

Results: One of the most frequent criticisms of the experiment was that Watson and Rayner taught

Hypothesis: Most human behaviors and emotional reactions are built up of conditioned responses. (When an emotionally exciting object stimulates the subject simultaneously with an object not emotionally exciting, the latter object may in time arouse the same emotional reaction as the former object.)

Method: Watson and Rayner presented Albert (a well-adjusted 9-month-old) with many objects, including a rat, blocks, a rabbit, a dog, a monkey, masks with and without hair, cotton, wool, and burning newspapers. Albert showed no fear of any of these objects—they were all neutral stimuli for the fear response.

Watson and Rayner decided that, when Albert was 11 months old, they would attempt to condition him to fear rats. They began by placing a furry white rat in front of him. Albert would reach out to touch it, and each time he did, one of Watson's assistants would strike a metal bar with a hammer behind Albert. The first time the metal bar was struck, Albert fell forward and buried his head in a pillow. The next time he reached for the rat and the bar

a well-adjusted child to be fearful. Apparently, the researchers knew at least one month ahead of time that Albert would be leaving the study, and yet they made no attempt to extinguish his conditioned fears (Harris, 1979). Psychologists today are unable to repeat the Little Albert study because of the ethical standards of the APA (see Chapter 2).

One of Watson's students, Mary Cover Jones (1924, 1974), developed an extinction procedure called counterconditioning to reduce people's existing fears. Peter was a boy who was extremely fearful of rabbits. Jones helped Peter eliminate his fear by pairing the feared object (the rabbit) with pleasant experiences, such as eating ice cream or receiving special attention.

Analyzing the Case Study

1. Did the results of Watson and Rayner's experiment support their hypothesis? Explain.
2. How did Albert's response become generalized?
3. **Critical Thinking** How were the principles of classical conditioning used to reduce Peter's fear of rabbits?