


Introductory Guide to Psychology

Chapter 9: Learning

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Learning

We begin learning the moment we are born, and this learning process continues throughout our lives. **Learning** is described by psychologists as a relatively permanent change in behavior or the potential to make a response that occurs as the result of experience. In this section, we will explore the three primary types of learning: classical (also called respondent) conditioning, operant (also called instrumental) conditioning, and observational learning.

Classical Conditioning

Most of us have had the experience of seeing a TV commercial for a juicy hamburger or slice of pizza that causes our mouths to water. Your mouth begins to water because you know from experience that the burger or slice of pizza tastes delicious and that when you first tasted it, it made your mouth water—this reaction is a learned response. Therefore, when you see the commercial with a picture of this same food item, your mouth begins to water because you have associated the picture with the taste of the food. This example demonstrates the cornerstone of classical conditioning learning theory. Most likely, you have never given an experience like this much thought—you probably didn't consider that what had occurred was the result of classical conditioning, a form of learning that occurs when two stimuli, a neutral stimulus and an unconditioned stimulus, are paired together and then become associated with each other.

Russian scientist, Ivan Pavlov (1849–1936) first established the criteria for classical conditioning. Much of Pavlov's work centered on research with dogs; he was investigating saliva's role in dogs' digestion when he stumbled across an interesting phenomenon. To get the dogs to salivate, Pavlov presented them with food, placing a few target morsels on their tongues. After working with the animals for several days, Pavlov noticed that the dogs began salivating before being presented with food—even as he entered the room. The dogs also slobbered at the sound of his approaching footsteps. This interested him so much that he began doing research to understand why this was occurring. In one set of experiments, Pavlov would ring a bell, which he referred to as a **neutral stimulus** (NS). Initially, the bell had no meaning at all to the dogs. However, this changed when he started feeding the animals immediately after ringing it. The food was an **unconditioned stimulus** (US)—an event that automatically produces a response without any previous training—that caused the dogs to begin drooling. Although the results so far were not unusual, Pavlov had established an important framework that would then create a change in the dogs' behavior. After repeating this procedure several times, Pavlov found that the dogs would start salivating at the sound of the bell alone (because they knew it would be accompanied by food). At this point, the scientist referred to the dogs as being classically conditioned to salivate to the sound of the bell, which had then become a **conditioned stimulus** (CS) because it elicited salivation, which was a **conditioned response** (CR) (see figure 9.1). This experiment proved that the dogs had learned to display a reflexive behavior to a new association—one that previously had no connection to the stimulus.

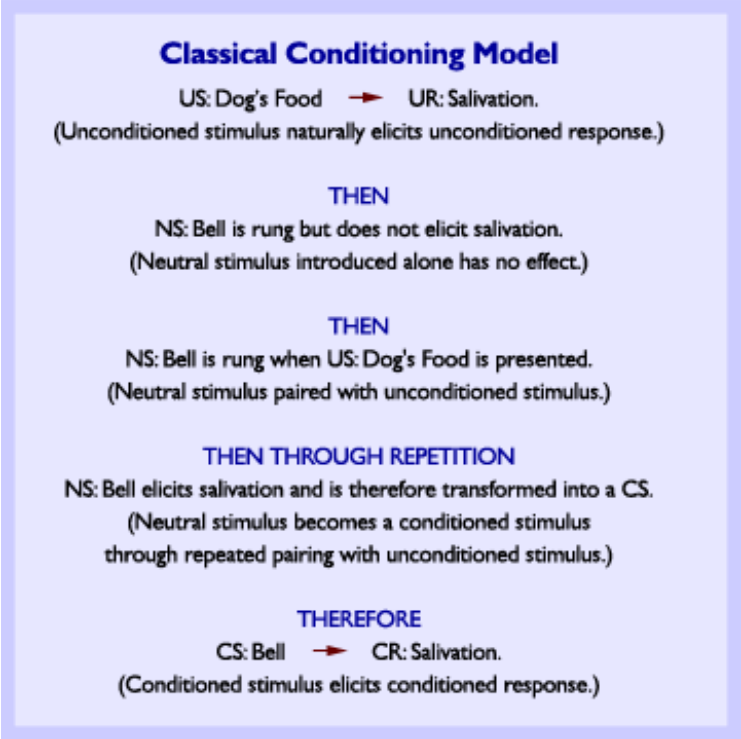

Figure 9.1 Pavlov's Experiment

In classical conditioning, no new behaviors are learned. Instead, an association is developed through the pairing of NS and US so that a person (or animal) responds to both stimuli in the same way. Another way of saying this is that after conditioning, both the US and the CS elicit the same involuntary response—a person (or animal) has learned to respond reflexively to a new stimulus.

Classical conditioning is how we often learn when we are young. Here is an example to illustrate this: your three-year-old brother comes into the kitchen and is just tall enough to reach a skillet on a hot stove. He instinctively reaches for the skillet and burns his hand. You comfort him, and the tears stop—but a few days later, he comes into the kitchen again, sees the same skillet, and begins to cry at the sight of it. The skillet has now taken on a new meaning (pain), and he has learned not to touch it. In classical conditioning terms, the skillet was a NS; after conditioning, it became a CS. The heat was an US, which elicited a response of pain Therefore the response—jerking the hand away—is an UR. After conditioning, when the CS is presented alone, it produces a response, the CR, which is very similar to the UR.

Classical conditioning is also the way many fears are created. When fear becomes very intense, it can become a **phobia**, which is irrational fear of objects, situations, or activities that is out of proportion to the actual danger presented. Phobias can be extremely debilitating; they can cause so much anxiety that they can interfere with normal functioning. We will learn more about phobias and anxiety disorders in a later chapter.

ASPECTS OF CLASSICAL CONDITIONING

Through Pavlov's early research, several other findings of classical conditioning were discovered. These findings fall into two categories: **acquisition**, which is how we develop a conditioned response, and **extinction**, which is how we eliminate these responses. The following characteristics are important, and psychologists often use them to treat phobias and other anxiety disorders.

Acquisition is a training stage in which a response is initially learned. Factors that influence acquisition are the order in which the CS and US are presented, the intensity of the US, and the number of times the CS and US are paired. The sequence influences the strength of conditioning (Sherman, 1978). As well as the sequencing, the strength of the US is important—the stronger the US, the stronger the conditioning. Added to this is the number of CS–US pairings; the more times the CS and the US are presented together, the stronger the CR becomes.

Extinction is an important concept in classical conditioning. For example, Pavlov wanted to extinguish the dogs' response of salivation only when the bell sounded. To do this, Pavlov repeatedly presented the bell *without* giving the dogs food, and over time, the dogs stopped salivating at the sound of the tone alone. Similarly, if your little brother touched a skillet several times when it was cold, his fear would decrease gradually each time.

Sometimes, after extinction, the CR returns, and when this occurs, it is referred to as **spontaneous recovery**. Again, using the example of Pavlov's dogs, after the tone was presented with no food, extinction occurred, and the dogs stopped responding with drool. However, the next day, one of the dogs began to salivate again when he heard the tone, because he forgot that there was no food presented with the bell the last several times. The CR had recovered some of the strength it lost during the extinction session.

GENERALIZATION AND DISCRIMINATION

Suppose your little brother goes into a department store, sees a display of skillets, and begins crying. Psychologists refer to this phenomenon as **generalization**, which occurs when a response occurs to a stimulus that is similar to the CS. In other words, a fear of something may spread to other situations. Using Pavlov's dogs as another example, the dogs may have started salivating when they heard other tones that were similar to the bell. **Discrimination** occurs when a person realizes that a similar stimulus in one situation is not the same in the next. For example, if a child is stung by a bee, he or she may develop a fear of *all* insects. However, after time, the child will probably learn that ladybugs, as well as many other types of insects, do not sting; therefore, the child has learned to discriminate.

Generalization and discrimination work in opposite ways; generalization makes you more likely to respond to a stimulus, and discrimination makes you less likely to respond to a stimulus.

Operant Conditioning

The second type of basic learning is operant conditioning, also referred to as instrumental conditioning. This type of learning or conditioning is contingent upon the theory that an organism operates on its environment to produce a change. Simply put, a person's behavior is **instrumental**—it directly results a change in the environment, and the type of change it produces is key in this type of learning.

REINFORCERS

Many of you study very hard, and this hard work is rewarded at the end of the term with an A grade; therefore your studying habits are **reinforced**. The concept of reinforcement is instrumental to how a person learns, starting at a young age and continuing throughout life. A **reinforcer** is an event or a stimulus that makes the behavior it follows more likely to occur (Skinner, 1938). The behavior that precedes the reinforcer is known as a **target response**. Therefore, using the example of studying and grades, we have already said that the reinforcer is the good grade—and the target behavior is studying, which has been increased.

Reinforcers can be either primary or secondary. A **primary reinforcer** is an event or stimulus that has innate reinforcing properties; in other words, you do not have to learn that such stimuli are reinforcers. A **secondary reinforcer** is a stimulus that becomes a reinforcement when it is associated with a primary reinforcer; you must learn that such stimuli are reinforcers. A good example of a secondary reinforcer is money. In and of itself, it has no intrinsic value, but when a child learns that it can be used to buy things, such as a candy bar or a new toy—both primary reinforcers—then it has value.

Both primary and secondary reinforcers can be negative or positive (Skinner, 1938). It is important to remember, however, that with both negative and positive reinforcers, the likelihood of a behavior being repeated is increased.

Positive reinforcers are stimuli or events that are presented after a target response occurs. The example of studying hard for an A grade is a positive reinforcer. Other examples of positive reinforcers include working each day at your job for a paycheck or spending hours cooking a meal for a fantastic dinner. The concept of positive reinforcers is a bit tricky, though, because positive reinforcers can sometimes have negative results! An example of this is cheating. Cheating may produce the same good grade as studying hard, and since the target response is the act of cheating itself, the behavior is likely to increase if a person gets a good grade. Are students deterred from cheating by the threat of being caught, which counteracts this reinforcer? Unfortunately not, as the number of students who admit to having cheated on college exams is very high: research indicates that 40 to 60 percent of college students report having cheated (Davis and Ludvigson, 1995). Another example of positive reinforcement that has negative results is the number of drunk drivers on the road; people continue to drive while intoxicated because they are reinforced by not being caught.

Negative reinforcers also increase the likelihood of a behavior reoccurring but are considered negative because a stimulus or an event is removed, which causes an increase in the response. To illustrate how negative reinforcement works, take this example: you are in an uncomfortably hot room. Any action that you take to change that situation, such as opening a window, would be negatively reinforced. That is, your window-opening behavior would be reinforced through the process of removing the unwanted stimulus, which in this case, is the excessive heat.

Using the example of studying and grades, a negative reinforcer would be studying harder so that you can increase your GPA. In this case, the undesirable stimulus is the bad grade, and the target behavior is studying harder. The concept of negative reinforcement is often confusing for people because of the connotations of the word, "negative." However, using the example of studying to increase your GPA, negative reinforcement can have a positive result.

Negative reinforcement should also not be confused with punishment, which has the opposite effect. A punisher *decreases* the likelihood that a response will be repeated. The most common example of a punishment is spanking a child to stop a behavior. The effectiveness of punishing is controversial; the typical view is that it does not work very well. Educator, E.L. Thorndike (1911) developed an influential theory of learning; one component of this theory was that of the **law of effect**, in which a "satisfier" (reinforcer) leads to a strengthening of new responses, whereas an "annoyer" (a punisher) leads to the weakening or unlearning of responses. From his experiments, Thorndike concluded that punishment might not be effective, but later psychologists theorized that he might have been too quick to dismiss its effectiveness. Just as there are negative and positive reinforcers, there are also negative and positive punishers. For example, if you scold your child for playing in the street, he or she will probably decrease that behavior, thereby producing good results; however, if you punish your child for his or her street-playing behavior, it may increase—the opposite of your intended effect.

THE SKINNER BOX

No one has contributed more to our understanding of operant conditioning than Harvard psychologist B.F. Skinner, who was influenced by one of the earliest behavioral psychologists, John B. Watson. If you will remember from the first chapter, "The History of Psychology," Watson believed that psychology was an approach to understanding how to predict and control behavior. Skinner took Watson's work to a new level and looked for stimuli that controlled behavior. He saw reinforcement as critical to this paradigm. Therefore, he began studying reinforcement and its effect on behavior. To isolate and test the effects of reinforcement, he developed a special testing environment called an operant conditioning chamber, but more commonly referred to as the **Skinner box** (see figure 9.2).

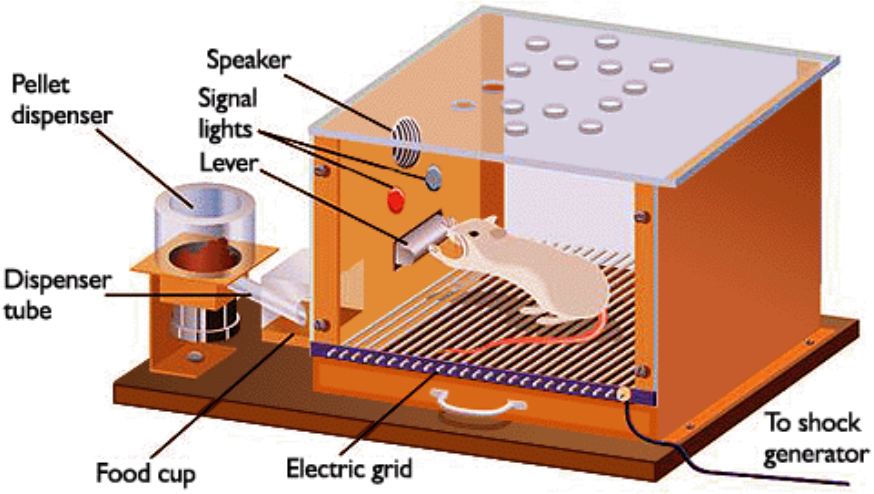

Figure 9.2 The Skinner Box

The Skinner box experiment presents a reinforcer such as a bit of food on a preset schedule to a hungry rat or pigeon (Skinner, 1938). A device known as a **cumulative recorder** logs the subject's responses on a result sheet, called a **cumulative record**. The preset pattern for delivering reinforcement is known as a **schedule of reinforcement.** These schedules are important in determining behavior, but before researchers can impose a schedule of reinforcement, the participant must demonstrate that he, she, or it is able to perform the target behavior. This is achieved through a process called shaping.

A rat placed in a Skinner box is not going to know that by pressing a lever, it will receive a reinforcement; a technique known as shaping teaches the rat to do this. **Shaping** involves reinforcing successive responses that more closely resemble the target response using a method of **successive approximations**. This is not as easy as it sounds, as presenting the reinforcers at exactly the right moment may be difficult. To teach a rat to push a lever to receive a reinforcer of food, the following steps are taken: First, when the rat is near the food dish, the researcher drops a piece of food into it; when the rat eats the food, the behavior of approaching the dish is reinforced. When the rat learns where the food is, the researcher begins offering reinforcers only when the rat goes near the lever. Gradually, the response requirements are made more difficult until the rat learns to touch the lever in order to receive the reinforcement. Once this has been learned, the researcher requires the rat to actually press down on the lever to receive the food. This can be a long process, but eventually the target behavior of the rat pressing the lever to receive food is achieved. In this way, the researchers have shaped the rat's behavior.

SCHEDULES OF REINFORCEMENT

Once the target behavior has been shaped, the researcher can arrange to have the reinforcer delivered according to a specific schedule (Ferster and Skinner, 1957). Schedules of reinforcement are important, as the right one can have an impact on both the strength and the frequency of a response. There are two types of schedules: continuous reinforcement and intermittent reinforcement.

Continuous reinforcement is the most basic schedule, in which the participant is given a reinforcement directly following each target response. For example, the rat in the Skinner box receives a morsel of food each time it presses the bar. Continual reinforcement produces a high response rate; however, once the reinforcer loses its effectiveness, this rate can drop quickly.

In an **intermittent reinforcement schedule**, responses are not rewarded continually. There are two types of intermittent schedules: ratio and interval. **Ratio schedules** work by determining the number of responses in which a participant receives reinforcement. For example, a participant may have to make three responses before receiving a reinforcement. When the number of responses is predetermined, it is called a **fixed ratio 1** (FR1) schedule. Alternatively, sometimes researchers may not want to specify the exact number of responses, in which case a **variable ratio** (VR) schedule is used. A good example of this type of reinforcement schedule in a nonlaboratory setting is that of a slot machine. People who feed money into slot machines are rewarded at certain points, but they do not know when that reward will come. When the timing of the reward is uncertain, they will continue to respond. This type of schedule usually has the highest response rate.

The second type of intermittent schedule of reinforcement is the **interval schedule**, which involves a passage of time before some responses are reinforced. Like ratio schedules, two types of interval schedules are used: fixed interval and variable interval. A **fixed interval** (FI) schedule uses a constant period of time that passes before a response is reinforced. No matter how many times you check your bank account, until your pay period arrives, no check (reinforcement) will be there. With a **variable interval** (VI) schedule, the participant has no idea when the reinforcement will occur. For this reason, the response rate is steady, but not particularly high. For example, if you call a phone number and it is busy, you will probably try again from time to time, but you most likely will not frantically dial the number continuously.

EXTINCTION

In operant conditioning, responses may be weakened and therefore may become less likely to occur; this process is also referred to as extinction. Suppose you were waiting to hear about a new job for which you applied; you would probably check your answering machine quite often to see if the potential employer had called. After some time, you would probably conclude that the employer was not planning to call, and this realization might change your response. You may not check your machine as often throughout the day or immediately after returning home. Classical and operant conditioning share similarities in that if a stimulus is not received, the result in both cases may be extinction.

However, in the case of the slot machine, extinction may not occur at all because the participants cannot tell whether the slot machine will pay off each time the lever is hit. With a variable ratio schedule, the response rate is high, and extinction is difficult because the reinforcement does not occur in a pattern. Therefore, if reinforcement is delivered in a predictable manner, extinction is much more likely to occur with a FR schedule than a VR schedule. Likewise, extinction is more likely to occur with FI training than VI training. A good deal of research has been done on these effects. The general pattern is referred to as the **partial reinforcement effect**, which states that extinction of operant behavior is more difficult after partial or intermittent reinforcement than after continuous reinforcement.

CLASSICAL AND OPERANT CONDITIONING		
Process	**Classical Conditioning**	**Operant Conditioning**
	A US causes a UR. After pairing a CS with a US several times, the CS comes to elicit a CR.	Reinforcement shapes a desired response; once established, a schedule of reinforcement may be used.
Acquisition (Training)	The CS and US are paired, after several pairings the CS elicits a CR.	When the target response is followed by a reinforcer, the response rate increases.
Extinction	The CS is presented alone and the CR is decreased.	The response rate decreases after reinforcement is discontinued.
Generalization	Similar stimuli elicit the same CR.	Responding occurs when stimuli similar to the discriminative stimulus are presented.
Discrimination	Similar stimuli do not elicit the CR.	Only the discriminative stimulus results in responding.

Table 9.1 Classical and Operant Conditioning

Observational Learning

For many years, behavioral psychologists believed that a response must be performed for learning to occur. Albert Bandura changed this view with his work on observational learning and the social learning theory. If you will recall from the "Research Methods in Psychology" chapter, Bandura conducted an experiment in the 1960s on the effects of violence on children. In this study, he found that a group of children who had observed an aggressive adult model hitting a Bobo doll were more likely than the control group of children who had observed a nonaggressive adult model (Bandura, 1977). Because the children made no responses while they were watching the violent behavior, Bandura concluded that a participant's observation of the behavior and reinforcement (or punishment) of another participant could result in learning. This type of learning is **observational learning**, and this approach is often called **social learning theory**.

Because we take in the world around us from the moment of birth, many argue that this type of learning has the greatest impact on how a child develops. Everything we learn about a society's norms, customs, and traditions is done through observational learning. At the heart of this theory is that the participant identifies with the person being observed and, putting himself or herself in the person's place, he or she can imagine the effects of the reinforcer or punisher. This effect is referred to as **vicarious reinforcement**.

Observational learning, also called **modeling** is so widespread; we don't even realize the extent to which it occurs. However, turn on the television and you will be inundated with commercials trying to convince you that if you buy a certain brand of cereal, you will become an athlete (Derek Jeter eats his Wheaties!) or if you drink a particular brand of beer, you will find yourself surrounded by gorgeous, scantily clad women. Bandura believed that the following conditions must be present for effective observational learning to occur:

1. The participant must *pay attention* to what the observed person does.
2. The modeled response will probably not occur immediately; therefore, a memory store of a situation must be made. Think of television jingles that linger in your head long past the time you viewed the commercial.
3. The behavior must be able to be repeated by the observer.
4. The observer's motivational state must be appropriate to the behavior.
5. The observer must know how to discriminate between an appropriate situation in which to model a behavior and one that is inappropriate.

Bandura's theory of observational learning has led many adults to be concerned about the possible effects of violent television programs, movies, and video games. In fact, research has indicated that there is a high correlation between those exposed to excessive levels of violence in the mass media and aggressive attitudes and behavior (Donnerstein, 1995).

Behavior Modification

Treatment approaches derived from operant conditioning have helped many individuals change destructive behaviors. Robert Watson introduced behavior modification in 1962, thereby starting a new field of psychological research and treatment. Behavior modification has been defined as "the application of the results of learning theory and experimental psychology to the problem of altering maladaptive behavior" (Ullman and Krassner, 1965). When applied correctly, behavior modification has been highly successful in treating a wide range of problems. We will encounter this technique in a later chapter that discusses different therapy approaches.

Summary

In this chapter, you have learned of the three basic types of learning; however, it is important to remember that although classical conditioning, operant conditioning, and observational learning have been presented separately, they often occur simultaneously. Memory and learning are closely tied with how we think; in the next chapter we will consider intelligence and how we use cognition.