

CHAPTER 5

Learning

CHAPTER OUTLINE

Adaptation is the adjustment to changes in the environment. The process of development, from birth to death, involves adapting to increasingly complex, ever-changing environments, using continuously updated knowledge and skills gained through experience. **Learning is a relatively permanent change in behavior or knowledge due to experience. We learn primarily by identifying relationships between events and noting the regularity of patterns in the world around us.**

I. CLASSICAL CONDITIONING: LEARNING SIGNALS AND ASSOCIATIONS

How did Russian dogs teach psychologists about learning?

A. Pavlov's Discovery

1. In his now classic experiment, Ivan Pavlov taught a dog to salivate at the sound of a bell.
 - a) First, he noted that a dog normally salivated when meat powder was put on its tongue (unlearned reflex), but not in response to a tone (neutral stimulus).
 - (1) A *reflex* is a swift, unlearned automatic response to a stimulus.
 - (2) A neutral stimulus is one that initially does not elicit the reflex being studied.
 - b) Second, he repeatedly paired a tone and the meat. Each time the tone was sounded, he put some meat powder on the dog's tongue.
 - c) Eventually, the dog salivated at the tone alone, even if no meat powder was given. The tone had come to predict the presentation of the meat powder.
2. Pavlov's experiment demonstrated **classical conditioning**, in which a neutral stimulus is repeatedly paired with a stimulus that already triggers a reflexive response until the previously neutral stimulus alone provokes a similar response.
 - a) The stimulus that already elicits a response without learning is the **unconditioned stimulus (UCS)**. The automatic, unlearned response to this stimulus is the **unconditioned response (UCR)**.
 - b) The **conditioned stimulus (CS)** begins as a neutral stimulus, but after pairing with the UCS it acquires the capacity to elicit the learned or **conditioned response (CR)**.

B. Conditioned Responses over Time: Extinction and Spontaneous Recovery

1. As a CS and a UCS are repeatedly paired, a CR is gradually learned, or acquired.
2. **Extinction** is the result of eliminating the UCS and repeatedly presenting the CS alone. Eventually, the CS will no longer elicit the CR.
3. **Reconditioning** is the quick relearning of a CR after extinction. Because reconditioning takes much less time than the original conditioning, extinction must not have completely erased the association between the conditioned stimulus and the conditioned response.
4. **Spontaneous recovery** is the temporary reappearance of the CR after extinction but without further CS-UCS pairings. In general, the longer the time between extinction and the reappearance of the CS, the stronger the recovered CR.

C. Stimulus Generalization and Discrimination

1. **Stimulus generalization** occurs when stimuli similar to the CS also elicit the CR. The strongest CRs are elicited by stimuli that are most similar to the "original" CS.
2. **Stimulus discrimination** complements generalization. Through stimulus discrimination you learn to differentiate between similar stimuli.

D. The Signaling of Significant Events

1. Organisms acquire CRs when one event reliably predicts or *signals* the UCS. Such learned associations help you construct *mental representations* of the relationships between events in their environment.
2. *Timing*. Classical conditioning works best when the CS precedes (predicts) the UCS. There is no single "best" interval for every situation. Classical conditioning will always

CHAPTER 5

Learning

CHAPTER OUTLINE

be weaker if the interval between the CS and the UCS is longer than what is ideal for the stimuli and responses in a given situation.

3. *Predictability.* It is insufficient for a CS to merely come before the UCS. Classical conditioning proceeds most rapidly when the CS *always* signals the UCS, and *only* the UCS—when the CS *reliably* predicts the UCS.
 4. *Signal strength.* A CR is learned faster when the UCS is strong. A CR will be learned more quickly if the cue or CS attracts your attention.
 5. *Attention* plays a role in classical conditioning. The stimulus that is most closely attended to and perceived is most likely to become a CS that later triggers a CR.
 6. **Second-order conditioning** occurs when a CS acts like a UCS, creating conditioned stimuli out of events associated with it.
 - a) *White coat hypertensives* have a rise in their blood pressure when the doctor or nurse becomes a CS for fear and their blood pressure rises as part of a CR fear response.
 7. Some stimuli are more easily associated with each other, perhaps because organisms are genetically “tuned” for certain kinds of learning.
 - a) An example of such **biopreparedness** may be conditioned taste aversion. If you become ill after tasting a certain food, you may later develop a learned nausea from that same taste. Taste aversions demonstrate that classical conditioning can occur even when there is a considerable delay between the CS (taste) and UCS (nauseous sensations).
- E. Some Applications of Classical Conditioning
1. Intense, irrational fears of objects or situations are called *phobias*. Some phobias (e.g., dog phobia) may be classically conditioned. Dangerous situations can produce classical conditioning of very long-lasting fears.
 - a) Phobias are often treated with *systematic desensitization*, a procedure that associates a new response (CR), such as relaxation, with a feared stimulus.
 2. *Diagnosis of Alzheimer's Disease.* Recent animal research has found that the hippocampus, which is damaged in the early stages of Alzheimer's disease, is involved in the development of the eyeblink conditioned response.

II. LINKAGES: LEARNING AND CONSCIOUSNESS

- A. **Habituation** is a simple form of learning in which there is reduced responsiveness to a repeated stimulus.
1. According to Solomon's *opponent-process theory*, habituation occurs because an automatic, involuntary response to a stimulus (UCR) is opposed by a subsequent learned response (CR). As UCS is repeated, the CR occurs more quickly and with greater intensity. As the CR more strongly counteracts the UCR the UCR gets smaller, resulting in habituation. This could be the basis for the development of drug tolerance and addiction.

III. INSTRUMENTAL AND OPERANT CONDITIONING: LEARNING THE CONSEQUENCES OF BEHAVIOR

How do reward and punishment work?

You also learn associations between your responses and the stimuli that follow—between behavior and its consequences.

- A. From the Puzzle Box to the Skinner Box

CHAPTER 5
Learning
CHAPTER OUTLINE

1. Edward Thorndike's *law of effect* states that if a response made to a stimulus is followed by satisfaction, that response is more likely to occur the next time the stimulus is present. He called this *instrumental conditioning*; responses are strengthened when they are instrumental in producing rewards.
 2. B. F. Skinner emphasized that an organism learns a response by trying actions that *operate on* the environment, so he called this operant conditioning.
 - a) Skinner devised the *Skinner box* to study conditioning.
- B. Basic Components of **Operant Conditioning**
1. *Operants and reinforcers*
 - a) An **operant** is a behavior that affects the world; it is a response that “operates” on the environment.
 - b) A **reinforcer** “strengthens” a behavior—it increases the chances that the operant will be repeated.
 - (1) **Positive reinforcers** strengthen a response if they are presented after that response occurs. *Positive reinforcement* is the presentation of a positive reinforcer after a response. *Example:* After a child cleans his room, his parent may give him ice cream. If the child likes ice cream, he should be more likely to clean his room again.
 - (2) **Negative reinforcers** are the removed of unpleasant stimuli after the response occurs. *Negative reinforcement* is the *removal* of a negative reinforcer after a response. *Example:* One learns to take aspirin for a headache because taking aspirin is followed by removal of the pain.
 2. *Escape and avoidance conditioning*
 - a) **Escape conditioning** is a response that ends an aversive stimulus and should be strengthened by negative reinforcement. *Example:* You may have learned to “terminate” intense cold by turning up the heat or putting on more clothing.
 - b) **Avoidance conditioning** occurs when you learn a response to a signal in a way that avoids exposure to an impending aversive stimuli.
 - (1) Avoidance conditioning is often a combination of classical and operant conditioning.
 - (2) Avoidance is a difficult habit to break because reduced fear reinforces avoidance responses. This prevents learning that avoidance may no longer be necessary or learning more adaptive behaviors for the situation.
Example: You may have learned to “avoid” the intense cold by going to a warm spot for the winter.
 3. *Discriminative stimuli and stimulus control*
 - a) **Discriminative stimuli** signal that reinforcement is available if a certain response is made. *Stimulus discrimination* occurs when an organism learns to make a particular response in the presence of one stimulus but not another. Under such conditions, the learned response is under *stimulus control*. *Example:* You may joke with your friends because you have learned that they will reward you with social praise for this. But you would not joke with a police officer who is giving you a traffic ticket. The two situations present different signals as to which behaviors are likely to be reinforced and which are not.
 - b) *Stimulus generalization* occurs when an organism makes a response in the presence of a stimulus that is similar, but not identical, to the one that previously signaled the availability of reinforcement. *Example:* A person reinforced with a cold drink for putting money into a Coke machine will probably produce the same response in the presence of a Pepsi machine.

CHAPTER 5
Learning
CHAPTER OUTLINE

- c) Prejudice is an example of category discrimination and then generalizations about categories of people.
- C. Forming and Strengthening Operant Behavior
- 1. *Shaping*
Shaping is the process of reinforcing *successive approximations* to the target behavior.
Example: If you want a hyperactive child to sit in his seat for ten minutes, you might shape this behavior by rewarding the child first for sitting. Then, you gradually set longer and longer times the child must remain sitting before he gets a reward. Eventually, the child will sit in his seat for ten minutes.
 - 2. *Secondary reinforcement*
 - a) **Primary reinforcers** are events or stimuli that satisfy needs basic to survival.
 - b) **Secondary reinforcers** are previously neutral stimuli that take on reinforcing properties if paired with already reinforcing stimuli. Thus, secondary reinforcers may be thought of as learned or *conditioned reinforcers*. The most obvious secondary reinforcer is money. *Example:* If your grandmother sang a certain song just before she gave you a cookie (a primary reinforcer), eventually the song alone will evoke positive feelings; it could reinforce your responses that preceded it.
 - 3. *Delay and size of reinforcement*
 - a) Consequences of behaviors have more impact when they occur immediately. *Example:* Right after you clean your dorm room, your roommate compliments you and buys you a pizza. This will affect your room cleaning behavior more strongly than would a pizza break a week later.
 - b) Conditioning proceeds faster as reinforcers become larger. *Example:* If your grandmother gave you \$20 every time you hugged her, the hugging would become an established behavior faster than if she gave you \$1 per hug.
 - 4. *Schedules of Reinforcement*
 - a) In a *continuous reinforcement schedule*, reinforcers follow every time the response occurs.
 - b) In a *partial, or intermittent, reinforcement schedule*, reinforcement occurs only part of the time.
 - (1) **Fixed-ratio (FR)** schedules give reinforcement only after a fixed number of responses or behaviors. *Example:* In a factory, workers may be paid \$1 for every five items produced.
 - (2) **Variable-ratio (VR)** schedules give reinforcers after an average number of responses, but number varies from one reinforcement to the next. *Example:* If you keep putting quarters into a slot machine until you win, sometimes it takes twenty quarters before a payoff, sometimes sixty, sometimes ten.
 - (3) **Fixed-interval (FI)** schedules give reinforcement for the first response after a fixed time has elapsed since the last reinforcer. *Example:* Coming to work on Friday results in a paycheck for work completed during the interval of a week.
 - (4) **Variable-interval (VI)** schedules reinforce the first response after some period of time, but the amount of time varies unpredictably. *Example:* If a friend wants to reinforce your studying behavior, she may come to your room and give you a chocolate if you are studying. If she followed a VI schedule, she might come in after ten minutes, then after thirty minutes, then after eighteen minutes, and so on.
 - c) Ratio-partial reinforcement schedules give the highest response rates, since reinforcement is still based on the *number* of responses. *Example:* Paying factory

CHAPTER 5
Learning
CHAPTER OUTLINE

workers on a *piecework* basis, tied to the number of items they produce, should yield a high rate of worker productivity.

- d) In fixed-partial reinforcement schedules, especially interval schedules, responding falls off just after a reinforcer, followed by ever-increasing responding as the next reinforcer nears.
- 5. *Schedules and Extinction*
 - a) Failure to reinforce a behavior should reduce its frequency and eventually extinguish it. *Example:* When a child throws temper tantrums she may be rewarded with parental attention. But when her parents stop paying attention to the tantrums, the tantrums may first intensify but will eventually stop.
 - b) The **partial-reinforcement extinction effect** describes the fact that behaviors learned with partial reinforcement are harder to extinguish than those learned with continuous reinforcement.
 - (1) *Accidental reinforcement*, a reinforcer following a behavior by chance, may explain learned superstitious behavior.
- D. Why Reinforcers Work
 - 1. Certain brain regions may play a special role in appreciating the reinforcing properties of stimuli. Particularly important are brain regions whose neurons use the neurotransmitter, dopamine.
- E. Punishment and Learning
 - 1. **Punishment** decreases the frequency of a behavior by presenting an aversive stimulus or removing a pleasant stimulus in order to decrease the frequency of the immediately preceding response. *Note:* Students often confuse negative reinforcement with punishment. Emphasize that the chances of a behavior are strengthened by negative reinforcement but are weakened by punishment.
 - 2. Using punishment has many drawbacks.
 - a) Punishment doesn't "erase" an undesirable behavior, merely suppresses it.
 - b) Punishment can have unwanted side effects. The child may come to associate the punisher with the punishment and come to simply fear the punisher.
 - c) Effective punishment must be given right after a response, and must follow every response.
 - d) Physical punishment can become aggression when given in anger and children may imitate the aggressiveness of some forms of punishment.
 - e) Punishment signals that inappropriate behavior has occurred but does not specify a correct alternative behavior.
 - 3. Punishment works best under certain conditions.
 - a) The punisher explains why punishment is being given.
 - b) The punisher emphasizes that the behavior that is being punished, not the child.
 - c) Punishment should be rapid and severe enough to eliminate the response without being abusive.
 - d) More appropriate responses are identified and reinforced.
- F. Operant Conditioning of Human Behavior
 - 1. Basic ideas of operant conditioning have endless examples in everyday life. Learning how to be "civilized" and cultural *gender roles*, are just two examples.
 - 2. Principles of operant conditioning have led to treatment programs for altering problematic behavior.
 - a) Behavior modification programs combine the use of rewards and extinction.

CHAPTER 5
Learning
CHAPTER OUTLINE

- b) Altering discriminative stimuli can help change behavior. *Example:* It may be easier to quit smoking if you avoid the places in which your smoking was most often reinforced.

IV. COGNITIVE PROCESSES IN LEARNING

Can people learn to be helpless?

Cognitive psychologists argue that both types of conditioning help animals and people to detect and understand what causes what. Conditioning may result not only from automatic associations, but also from the mental processes that underlie adaptation to and understanding of the world around us.

A. Learned Helplessness

- 1. **Learned helplessness** is a tendency to give up on efforts to control the environment.
 - a) Learned helplessness makes animals endure painful situations passively, without trying to escape.

B. Focus on Research Methods: The “I Can’t Do It” Attitude

- 1. *What was the researcher’s question?* Donald Hiroto wanted to know if learned helplessness could occur in humans as well as in animals.
- 2. *How did the researcher answer the question?* Subjects first heard a series of thirty bursts of loud, obnoxious noises. Some subjects had no control over these noises, others could push a button to turn off the noise, and others heard no noises at all. Then, all subjects were given a series of eighteen noise bursts. Before each noise, a red warning light appeared. All subjects could move a lever either left or right to terminate the noise (varied for each noise burst) or even prevent it if they moved fast enough.

Just before these eighteen trials, half of the subjects were told that avoiding or escaping noises depended on their lever-moving skill. The other half were told that success would be a matter of chance.

- 3. *What did the researcher find?* The results were that people who had earlier experienced noises with no control failed to terminate the now controllable noises four times as often as the other subjects. Also, no matter what the subjects had experienced before, those who *expected* that control depended on skill terminated more controllable noises than those who thought that control depended on chance.
- 4. *What do the results mean?* It appears that the belief of learned helplessness—either through direct experience or through expectation—makes people less likely to use available control. *Example:* A student who consistently receives failing grades no matter how hard he studies may stop trying to pass, even when presented with a passable exam.
- 5. *What do we still need to know?* Further research is needed on when and how learned helplessness affects people’s thoughts, feelings, and actions. People with *pessimistic explanatory style* see good things that happen to them as temporary and due to chance, whereas the bad things are seen as permanent and due to internal factors. Research is needed to understand the connection and to determine how to minimize learned helplessness and maximize learned optimism.

C. Latent Learning and Cognitive Maps

- 1. **Latent learning** is learning that is not evident when it first occurs.
 - Example:* A child may watch a film showing how to check a book out of the library. He may have learned behaviors from this experience, even though he may not overtly demonstrate the learning until he goes to a library.
 - a) Tolman took 3 groups of rats. Group A had food placed in the goal box of the maze each trial and they gradually improved their maze running performance.

CHAPTER 5

Learning

CHAPTER OUTLINE

Group B never had food placed in the goal box and continued to make many errors. Group C had no food in the goal box for the first 10 days and made many mistakes. On the 11th day food was placed in the box and the rats made almost no mistakes after receiving reinforcement. Tolman argued that the reinforcement did not affect learning, but only the rats' performance.

- b) **Cognitive maps** are mental representations of physical arrangements. Cognitive maps develop as you explore your surroundings, although you may not show an overt response or receive explicit reinforcement.
 2. These forms of learning do not result from reinforcing overt responses. They imply that learning can sometimes rely on cognitive processes like understanding and making inferences.
- D. Insight and Learning
1. Kohler studied **insight** learning, in which animals and people appear to “suddenly” solve a problem. He argued that it was different from trial and error because once the problem was solved, a similar situation would evoke a similar response. Also a solution that did not work was rarely tried. Other psychologists argue that insight is the result of a “mental trial and error” process.
- E. Observational Learning: Learning by Imitation
1. In **observational learning**, also known as *social learning*, is learning that occurs by watching others.
 - a) *Modeling and vicarious conditioning*. Children are particularly influenced by the adults and peers who act as *models* for appropriate behavior. **Vicarious conditioning** is a kind of observational learning through which a person is influenced by watching or hearing about the consequences of other's behavior. Fears can be learned by watching fearfulness in others.
- F. *Thinking Critically: Does Watching Violence on Television Make People More Violent?*
The average child in the United States spends about two and one-half hours each day watching television, and much of what he or she sees is violent programming. The average child will see 8,000 murders and 100,000 other acts of televised violence before finishing elementary school, and twice that number by age 18. Would watching so much violence make children desensitized to violence, or more likely to learn to behave violently?
1. *What am I being asked to believe or accept?*
Exposure to television violence results in increased aggressive behavior, both contemporaneously and over time.
 2. *Is there evidence available to support the assertion?*
Some evidence comes from anecdotes and case studies. In correlational studies, children who watch more violence on television are more aggressive, even twenty years later. Experiments show that children shown violent television shows display more violent behavior than children shown nonviolent shows.
 3. *Can that evidence be interpreted another way?*
Anecdotes and case studies are open to many interpretations. Correlations do not imply causation—it may be that watching television violence and behaving violently are *both* caused by a third factor; such as personality or poverty, the effects of drugs and alcohol, or more stressors. Some experiments may also not be applicable beyond the experimental setting.
 4. *What evidence would help to evaluate the alternatives?*

CHAPTER 5
Learning
CHAPTER OUTLINE

Further evidence from controlled experiments and a better understanding of how observed violence relates to other causes of aggressive behavior would be helpful.

5. *What conclusions are most reasonable?*
Based on current evidence, it is reasonable to conclude that watching television violence is one cause of violent behavior, especially in some children.

V. USING RESEARCH ON LEARNING TO HELP PEOPLE LEARN

What should teachers learn about learning?

A. Classrooms across Cultures

1. In a typical U.S. classroom session, teachers address students as a group, students work independently at their desks, and feedback and reinforcement is delayed a day or two or not given at all. In Japanese classrooms, teachers work with students on a one-to-one basis with immediate feedback, and students are encouraged to form teams that include people of varying skills and abilities and to work together cooperatively.
2. The Japanese children practiced more, spent more days in school during the year, and more hours doing homework.
3. Research suggests that application of basic principles of operant conditioning can improve education.
4. Research in cognitive psychology suggests that students will retain more of what they learn if they study in several sessions “distributed” over time rather than in single “cramming” sessions.

B. Active Learning

1. **Active learning**, in which the student must do something other than simply sit and listen, is generally more interesting and enjoyable for students, and is associated with greater in-depth understanding of material.

C. Skill Learning

1. Improvement of skills requires both physical and mental practice. Practice should continue past the point of correct performance until the skill can be performed automatically, with little or no attention.
2. Feedback about the correctness of the response is necessary. Large amounts of guidance may produce very good performance during practice, but too much of it may impair later performance.
3. There is little or no evidence to support “sleep learning” or similar schemes designed to make learning effortless.