Chapter 5: Learning

I. Introduction: What Is Learning?
   A. Psychologists define learning as a process that produces a relatively enduring change in behavior or knowledge as a result of an individual’s experience.
   B. Conditioning is the process of learning associations between environmental events and behavioral responses. There are two basic types of conditioning:
   1. Classical conditioning explains how certain stimuli can trigger an autonomic response.
   2. Operant conditioning explains how we acquire new, voluntary actions.
   C. Observational learning is how we acquire new behaviors by observing the actions of others.

II. Classical Conditioning: Associating Stimuli
   Ivan Pavlov was a Russian physiologist who first described the basic process of conditioning that is now called classical conditioning.
   1. He was awarded the Nobel Prize for his work on the role of saliva in digestion.
   2. To elicit salivation, Pavlov placed food on dogs’ tongues. After several days, Pavlov observed that the dogs began salivating before the presentation of food (stimulus). Salivating is a reflex—a largely involuntary, automatic response to an external stimulus. Salivation should have occurred after food was presented.
   A. Principles of Classical Conditioning
      1. Essentially, classical conditioning is a process of learning an association between two stimuli; it involves pairing a neutral stimulus with an unlearned, natural stimulus that automatically elicits a reflexive response.
      2. The natural stimulus that reflexively produces a response without prior learning is called the unconditioned stimulus (UCS).
      3. The unlearned, reflexive response that is elicited by an unconditioned stimulus is called the unconditioned response (UCR).
      4. The conditioned stimulus (CS) is an originally neutral stimulus that comes to elicit a reflexive response.
5. The **conditioned response (CR)** is the *learned*, reflexive response to a previously neutral stimulus.

6. The unconditioned response and the conditioned response are essentially the same.

**B. Factors That Affect Conditioning**

1. The more frequently the conditioned stimulus and unconditioned stimulus are paired, the stronger is the association between the two.

2. The *timing* of stimulus presentations also affects the strength of the conditioned response; conditioning is most effective when the conditioned stimulus is presented immediately *before* the unconditioned stimulus. A half-second is the optimal time interval.

3. **Stimulus Generalization and Discrimination**
   a. **Stimulus generalization** occurs when stimuli that are similar to the original conditioned stimulus elicit the conditioned response, even though they have never been paired with the unconditioned stimulus.
   b. **Stimulus discrimination** occurs when a particular conditioned response is made to one specific stimulus but not to other, similar stimuli.

4. **Higher-Order Conditioning**
   a. Pavlov found that a conditioned stimulus could itself function as an unconditioned stimulus in a new conditioning trial, called *higher-order conditioning*.
   b. It is important to note that in higher order conditioning, the new conditioned stimulus has *never* been paired with the unconditioned stimulus.
   c. Example: Infant Laura, after receiving vaccination injections from a white-jacketed nurse, reacted fearfully to a wide range of white uniforms.

5. **Extinction and Spontaneous Recovery**
   a. In classical conditioning, **extinction** is the gradual weakening and apparent disappearance of the conditioned response. Extinction occurs when the conditioned stimulus is repeatedly presented *without* being paired with the unconditioned stimulus.
   b. **Spontaneous recovery** is the reappearance of a previously extinguished conditioned response after a
period of time without exposure to the conditioned stimulus.

C. From Pavlov to Watson: The Founding of Behaviorism

1. In the early 1900s, John B. Watson, an American psychologist, founded a new school, or approach, in psychology called behaviorism.
   a. Watson emphasized the scientific study of behavior and rejected the methods of introspection and the study of consciousness.
   b. Watson believed that virtually all human behavior is the result of past experience and environmental influences.

2. Behaviorism dominated psychology in the United States for more than 50 years.

D. Conditioned Emotional Reactions

1. Watson identified three emotions that he believed were innate unconditioned reflexes—fear, rage, and love. Each could be reflexively triggered by a small number of specific stimuli.

2. The Famous Case of Little Albert
   a. In 1920, Watson and graduate student Rosalie Rayner set out to demonstrate that classical conditioning could be used to deliberately establish a conditioned emotional response in a human subject.
   b. Nine-month-old Albert showed no fear when presented with a tame white rat, a rabbit, a dog, and a monkey.
   c. When a steel bar was banged behind his head (unconditioned stimulus), Albert responded with fear (unconditioned response).
   d. After seven pairings of the loud noise and the white rat (conditioned stimulus), the white rat alone triggered extreme fear (the conditioned response).
   e. Stimulus generalization also occurred: Little Albert was now afraid of other furry animals and a variety of fuzzy objects.
   f. Criticisms: The study was not carefully designed or conducted, and the researchers made no effort to extinguish the fear.

E. Other Classically Conditioned Responses

1. Virtually any automatic response can become classically conditioned.
2. Stimuli that reliably accompany the administration of a drug used to restore normal levels of functioning can become classically conditioned so that they elicit responses similar to the drug’s effects.

3. Conditioned drug effects can contribute to some instances of placebo response (or placebo effect)—an individual’s psychological and physiological response to a fake treatment or drug.

4. In Focus: Watson, Classical Conditioning, and Advertising
   a. Watson left academia and joined the J. Walter Thompson advertising agency. He was a pioneer in applying classical conditioning principles to advertising.
   b. Associating advertising images with emotional responses has been shown by research to be effective in influencing attitudes toward products or brands.

III. Contemporary Views of Classical Conditioning
Contemporary learning researchers acknowledge the importance of both mental factors and evolutionary influences in classical conditioning.

A. Cognitive Aspects of Classical Conditioning: Reliable Signals
   1. According to American psychologist Robert A. Rescorla, classical conditioning depends on the information the conditioned stimulus provides about the unconditioned stimulus. For learning to occur, the conditioned stimulus must be a reliable signal that predicts the presentation of the unconditioned stimulus.
   2. From his studies of classical conditioning in rats, Rescorla concluded that animals assess the predictive value of stimuli.
   3. Based on studies by Rescorla and others, classical conditioning seems to involve learning the relationships between events.

B. Evolutionary Aspects of Classical Conditioning: Biological Predispositions to Learn
   1. According to Darwin’s theory of evolution by natural selection, both the physical characteristics and the natural behavior patterns of any species have been shaped by evolution to maximize adaptation to the environment. According to traditional behaviorists, the general principles of learning applied to virtually all animal species and all learning situations. However, in the 1960s, researchers began to report “exceptions” to these principles.

a. A **taste aversion** is a classically conditioned intense dislike for and avoidance of a particular food that develops when an organism becomes ill after eating the food.

b. Taste aversions seem to violate two basic principles of classical conditioning:

   1. Conditioning does not require repeated pairings; it can occur in a *single pairing* of the conditioned stimulus and the unconditioned stimulus.

   2. The time span between two stimuli can be several hours, not a matter of seconds.

c. **John Garcia** demonstrated that taste aversions could be produced in laboratory rats under controlled conditions. His findings challenged several of the basic assumptions of classical conditioning.

   1. Conditioned taste aversions challenge the notion that virtually any stimulus can become a conditioned stimulus.

   2. Garcia found that rats were more likely to associate a *painful stimulus*, such as a shock, with *external stimuli*, such as flashing lights and noise.

   3. Rats were more likely to associate a *taste stimulus* with *internal stimuli* (the physical discomfort of illness).

d. **Biological preparedness** is the idea that an organism is innately predisposed to form associations between certain stimuli and responses.

3. In Focus: Evolution, Biological Preparedness and Conditioned Fears: What Gives You the Creeps?

a. Research supports the idea that humans are biologically prepared to develop fears (*phobias*) of objects or situations—such as snakes, spiders, and heights—that may once have posed a threat to humans’ evolutionary ancestors.

b. Humans may have evolved perceptual mechanisms that automatically identify stimuli that are related to threatening encounters in the evolutionary past.
IV. Operant Conditioning: Associating Behaviors and Consequences

Operant conditioning deals with the learning of active, voluntary behaviors that are shaped and maintained by their consequences.

A. Thorndike and the Law of Effect

1. Edward L. Thorndike was the first psychologist to systematically investigate animal behavior and how voluntary behaviors are influenced by their consequences.
   2. Thorndike placed hungry cats in “puzzle boxes” that allowed escape by some simple act. Through trial and error, the cats learned to unlatch the puzzle box door and escape.
   3. On the basis of his observations, Thorndike formulated the law of effect: Responses followed by a “satisfying state of affairs” are “strengthened” and are more likely to occur again in the same situation, whereas responses followed by an unpleasant or “annoying state of affairs” are “weakened” and less likely to occur again.

B. B. F. Skinner and the Search for “Order in Behavior”

1. American psychologist B. F. Skinner searched for the “lawful processes” that would explain “order in behavior.” He believed that psychology should restrict itself to studying only phenomena that could be objectively measured and verified—outwardly observable behavior and environmental events.
   2. To Skinner, the most important form of learning was demonstrated by new behaviors that were actively emitted by the organism.
   3. Skinner coined the term operant to describe any “active behavior that operates upon the environment to generate consequences.” In other words, his principles of operant conditioning explain how we acquire the wide range of voluntary behaviors we perform in daily life.

C. Reinforcement: Increasing Future Behavior

Operant conditioning, or Skinnerian conditioning, explains learning as a process in which behavior is shaped and maintained by its consequences.

1. Positive and Negative Reinforcement
   a. Reinforcement is said to occur when a stimulus or an event follows an operant and increases the likelihood of the operant being repeated.
   b. Positive reinforcement involves following an operant with the addition of a reinforcing stimulus. Positive
reinforcement has occurred if the response is strengthened, that is, if the organism is more likely to repeat the operant in similar situations in the future. What constitutes a reinforcing stimulus can vary from person to person, species to species, and situation to situation.

c. **Negative reinforcement** involves an operant that is followed by the removal of an aversive stimulus. Negative reinforcement has taken place if escaping from or avoiding the aversive event has the effect of making the organism more likely to repeat the operant in similar situations in the future. *Aversive stimuli* typically involve physical or psychological discomfort that an organism seeks to escape or avoid, called *escape behavior* or *avoidance behavior*.

2. **Primary and Conditioned Reinforcers**
   a. A **primary reinforcer** is one that is naturally reinforcing for a given species, such as food, water, adequate warmth, and sexual contact.
   b. A **conditioned reinforcer**, or *secondary reinforcer*, is one that has acquired reinforcing value by being associated with a primary reinforcer; money is a conditioned reinforcer.

D. **Punishment: Using Aversive Consequences to Decrease Behavior**

1. **Punishment** is a process in which a behavior is followed by an aversive consequence that decreases the likelihood of the behavior’s being repeated.

2. Two types of aversive events can act as punishment.
   a. **Punishment by application**, or *positive punishment*, involves a response being followed by the presentation of an aversive stimulus.
   b. **Punishment by removal**, or *negative punishment*, involves a response being followed by the loss or withdrawal of a reinforcing stimulus.

3. Punishment is more effective if it immediately and consistently follows a response.

4. Punishment has several drawbacks: It doesn’t teach a more appropriate response; it may have undesirable results, such as complete passivity, fear, anxiety, or hostility; and its effects are likely to be temporary.
5. In Focus: Changing the Behavior of Others: Alternatives to Punishment

Skinner strongly opposed the use of punishment; he advocated the greater use of positive reinforcement to strengthen desirable behaviors. The effectiveness of positive reinforcement can be enhanced in several ways.

a. Reinforce an incompatible behavior (alternative behavior)
b. Stop reinforcing the problem behavior
c. Reinforce the non-occurrence of the problem behavior
d. Remove the opportunity to obtain positive reinforcement

6. Critical Thinking: Is Human Freedom Just an Illusion?

Skinner believed that operant conditioning principles could, and should, be applied on a broad scale to help solve society’s problems. His most controversial idea was that free will, self-determination, and individual choice are just an illusion.

E. Discriminative Stimuli: Setting the Occasion for Responding

1. A **discriminative stimulus** is the specific stimulus in the presence of which a particular operant is more like to be reinforced.

2. In Skinner’s view, an individual’s behavior is *not* determined by a personal choice or a conscious decision but rather by environmental stimuli and the person’s reinforcement history in that environment.

F. Shaping and Maintaining Behavior

1. To scientifically study the relationship between behavior and its consequences in the laboratory, Skinner invented the **Skinner box**, or **operant chamber**; it is a small cage with a food dispenser and a device that automatically records the number of operants made by an experimental animal, usually a rat or a pigeon.

2. **Shaping** involves reinforcing successively closer approximations of a behavior until the correct behavior is displayed.

3. The Partial Reinforcement Effect: Building Resistance to Extinction

   a. **Continuous reinforcement** is a pattern of reinforcement in which *every* occurrence of a particular response is reinforced.
b. **Partial reinforcement**, by contrast, is a pattern of reinforcement in which the occurrence of a particular response is only sometimes followed by a reinforcer.

c. **Extinction** in operant conditioning is the gradual weakening and disappearance of conditioned behavior. It occurs when a behavior is no longer followed by a reinforcer.

d. The **partial reinforcement effect** is the phenomenon in which behaviors that are conditioned using partial reinforcement are more resistant to extinction than behaviors that are conditioned using continuous reinforcement.

4. **The Schedules of Reinforcement**

   Schedules of reinforcement are specific preset arrangements of partial reinforcement that produce different patterns and rates of responding.

   a. With a **fixed-ratio (FR) schedule**, reinforcement occurs after a fixed number of responses. Fixed-ratio schedules typically produce a high rate of responding that follows a burst–pause–burst pattern.

   b. With a **variable-ratio (VR) schedule**, reinforcement occurs after an *average* number of responses, which varies from trial to trial. Variable-ratio schedules produce high, steady rates of responding with hardly any pausing between trials or after reinforcement.

   c. With a **fixed-interval (FI) schedule**, a reinforcer is delivered for the first response emitted after the preset time interval has elapsed. Fixed-interval schedules produce a pattern of responding in which the number of responses tends to increase as the time for the next reinforcer draws near.

   d. With a **variable-interval (VI) schedule**, reinforcement occurs for the first response emitted after an average amount of time has elapsed, but the interval varies from trial to trial. Variable interval schedules tend to produce moderate but steady rates of responding.

G. **Applications of Operant Conditioning**

1. **Behavior modification** is the application of learning principles to help people develop more effective or adaptive
behaviors. The systematic use of reinforcement and shaping results in the increased occurrence of desirable behaviors.
2. Behavior modification has been used for improving worker performance, increasing social skills in children, and promoting sleep at night, for example.
3. Focus on Neuroscience: Virtual Operant Conditioning: Remote-Controlled “Ratbots”
Researchers have found that rats can be trained to locate trapped victims of natural disasters with stimulation of the medial forebrain bundle (MFB).

V. Contemporary Views of Operant Conditioning
   A. Cognitive Aspects of Operant Conditioning
      Today’s learning researchers acknowledge the importance of both cognitive and evolutionary factors in operant conditioning.
      1. American psychologist Edward C. Tolman believed that cognitive processes played an important role in the learning of complex behaviors—even in rats.
      2. Tolman believed that maze-running rats learned more than a simple sequence of responses; rather, they developed a cognitive map, or mental representation, of the layout of the maze.
      3. Tolman challenged the prevailing behaviorist model on another important point. Tolman concluded that reward—or reinforcement—is not necessary for learning to take place. Even in the absence of a reward, latent learning—learning that is not immediately demonstrated in overt behavior—occurred.
      4. Many contemporary cognitive learning theorists follow Tolman in his belief that operant conditioning involves the cognitive representation of the relationship between a behavior and its consequence. Today, operant conditioning is seen as involving the cognitive expectancy that a given consequence will follow a given behavior.
   B. Learned Helplessness: Expectations of Failure and Learning to Quit
      1. Learned helplessness is the phenomenon in which exposure to inescapable and uncontrollable aversive events produces passive behavior.
      2. Studies have demonstrated learned helplessness in many species, including humans.
3. Learned helplessness has been shown to play a role in psychological disorders, particularly depression, and in the way people respond to stressful events.

C. Operant Conditioning and Biological Predispositions: Misbehaving Chickens

1. Psychologists studying operant conditioning have found that an animal’s natural behavior patterns can influence the learning of new behaviors.
2. **Instinctive drift** is the tendency of an animal to revert to its instinctive behaviors that can interfere with the performance of an operantly conditioned response.

VI. Observational Learning: Imitating the Actions of Others

**Observational learning** is learning that occurs through observing the actions of others.

1. **Albert Bandura** believes that observational learning is the result of cognitive processes that are “actively judgmental and constructive,” not merely “mechanical copying.”
2. Bandura believes that reinforcement is not essential for learning to occur; rather, the expectation of reinforcement affects the performance of what has been learned.
3. Bandura suggests that four cognitive processes interact to determine whether imitation will occur.
   a. paying attention to the other person’s behavior,
   b. forming and storing mental representations of the behavior to be imitated,
   c. transforming this mental representation into actions you are capable of reproducing, and
   d. being motivated to imitate the behavior by some expectation that doing so will produce reinforcement or reward.

A. Observational Learning in Animals

Many nonhuman animals are capable of learning new behaviors through observation and imitation.

1. Focus on Neuroscience: Mirror Neurons: Imitation in the Brain?
   a. In the 1990s, research from Rizzolatti and colleagues discovered **mirror neurons**, which are neurons that fire both when an action is performed and when the action is simply perceived.
b. Many neuroscientists and psychologists believe mirror neurons play an important role in imitation and observational learning.

B. Applications of Observational Learning
1. Researchers have been particularly interested in studying how media portrayals of both negative and positive behaviors affect the behavior of viewers.
2. Observational learning has been applied in a variety of settings, including education, vocational and job training, psychotherapy, and counseling.
3. Critical Thinking: Does “Reel” Violence Cause Real Aggressive Behavior?
   Research evidence suggests that reduced exposure to TV violence can reduce aggressive behavior. Although people do not necessarily become violent from watching violence on TV, researchers note that one-quarter of viewers (primarily those who already have aggressive tendencies) are likely to become more aggressive.

VII. Application: Using Learning Principles to Improve Self-Control
A. Self-control often involves choosing between two reinforcers: (1) a longterm reinforcer that will provide a gratification at some point in the future or (2) a short-term reinforcer that provides immediate gratification but gets in the way of obtaining a long-term reinforcer.
B. We often choose short-term reinforcers because the relative value of reinforcers can shift over time. That is, the availability of an immediate, short-term reinforcer can temporarily outweigh the subjective value of a long-term reinforcer in the distant future.
C. Strategies for resisting the temptation of short-term reinforcers and improving self control:
   1. Precommitment: Make an advance commitment to your long-term goal.
   2. Self-Reinforcement: Use self-reinforcement for current behaviors related to your long-term goal.
   3. Stimulus Control: Replace environmental cues that are likely to trigger unwanted behaviors with others that will help you achieve your long-term goals.
   4. Focus on the Delayed Reinforcer: Selectively focus on the delayed reinforcer to mentally bridge the gap between the present and the ultimate attainment of your future goal.
5. Observe Good Role Models: Look for good role models and imitate their behavior.