Learning

I. INTRODUCTION

A. LEARNING

1. A lasting change in behavior or mental processes as the result of an experience.
2. Also note that while behavior can be observed, mental processes are much more difficult to study.

B. INSTINCTS VERSUS LEARNING

1. Instincts are unlearned behaviors due to evolutionary programming that are found in almost all members of a species. For example, bears hibernate, geese migrate, and salmon swim upstream to spawn.
2. Learning represents a significant evolutionary advance over instinctive behavior. Learning enables humans to acquire new knowledge that can be transferred from one generation to another.

II. CLASSICAL CONDITIONING

A. IVAN PAVLOV (1849–1936)

1. Ivan Pavlov was a Russian (and later Soviet) physiologist who was awarded a Nobel Prize in 1904 for his research on the digestive system of dogs.
2. While conducting experiments, Pavlov noticed that his dogs tended to salivate before food was actually delivered to their

mouths. Pavlov devoted three decades and 532 carefully designed experiments to studying the principles of classical conditioning.

3. The learning processes that Pavlov discovered are called classical conditioning because they were the first to be extensively studied in psychology.

B. FIVE COMPONENTS OF CLASSICAL CONDITIONING

1. Unconditioned stimulus (UCS)
   - *A natural stimulus that reflexively elicits a response without the need for prior learning.*
   - *Pavlov used food as the unconditioned stimulus because it produced a naturally occurring salivation reflex.*
   - *Remember that the word "condition" means "learned." Thus, an unconditioned stimulus is really an "unlearned stimulus."*
2. Unconditioned response (UCR)
   - *An unlearned response that is elicited by an unconditioned stimulus.*
   - *In Pavlov's experiments, salivation was the unconditioned response.*
3. Neutral stimulus (NS)
   - *Any stimulus that produces no conditioned response prior to learning.*
   - *In Pavlov's experiments a ringing bell was originally a neutral stimulus.*
4. Conditioned stimulus (CS)
   - *The conditioned stimulus was originally the neutral stimulus. When systematically paired with the unconditioned stimulus, the neutral stimulus becomes a conditioned (or learned) stimulus as it gains the power to cause a response.*
   - *In Pavlov's experiments, the ringing bell became a conditioned stimulus when it began to produce the same salivating response that the food once produced.*
5. Conditioned response (CR)
   - *A conditioned response is a learned response elicited by the conditioned stimulus.*
   - *Pavlov called the process by which a conditioned stimulus elicits a conditioned response "acquisition."*

- *In Pavlov's experiments, he paired the ringing bell with food. Originally a neutral stimulus, the ringing bell became a conditioned stimulus when the dog reacted with a conditioned response by salivating. The dog thus formed a new, learned association between a ringing bell and the food.*
- *In Pavlov's experiments, the dog's salivation was both an unconditioned response and a conditioned response.*
- *Classical conditioning is most efficient when the conditioned stimulus immediately precedes the unconditioned stimulus.*

6. Example
   - *Every time someone flushes a toilet in a health club locker room, the nearby shower becomes hot. The sudden stream of hot water causes the person taking a nearby shower to jump back. Over time, the person hears the flush and then automatically jumps back before the water temperature changes.*
   - *In this example, the hot water is the unconditioned stimulus and jumping back is the unconditioned (and thus automatic) response. The toilet flush was originally a neutral stimulus that when paired with the hot water became a conditioned stimulus. The flushing sound thus elicits the conditioned response of jumping back before the hot water appears.*

C. EXTINCTION AND SPONTANEOUS RECOVERY

1. Extinction is the gradual weakening of a conditioned behavior when the conditioned stimulus is not followed by the unconditioned stimulus. For example, in Pavlov's experiments he presented the ringing bell without the food. As a result, the ringing bell gradually lost its power to elicit the conditioned response of salivation.
2. Spontaneous recovery is the reappearance of an extinguished conditioned response after a time delay. For example, Pavlov discovered that after a period of time, his dogs began salivating when they heard the sound of the bell. Note that the conditioned response reappeared at a lower intensity.
3. Spontaneous recovery shows how difficult it can be to eliminate a conditioned response. The noted psychologist

Philip Zimbardo points out that "extinction merely suppresses the conditioned response. What actually seems to be happening during extinction is the learning of a competing response *not to respond* to the conditioned stimulus."

D. STIMULUS GENERALIZATION AND DISCRIMINATION

1. Stimulus generalization
    - *Occurs when stimuli that are similar to the original stimulus also elicit the conditioned response. It is important to remember that the new stimulus was not paired with the unconditioned stimulus.*
    - *For example, Pavlov found that a dog conditioned to a low-pitched tone would also respond to a high-pitched tone.*
2. Stimulus discrimination
    - *The ability to distinguish between two similar stimuli.*
    - *For example, students have learned different responses to the sound of bells in classrooms, cell phones, and front doors. Similarly, gardeners demonstrate stimulus discrimination when they respond differently to weeds and to flowers.*
3. Example
    - *A young boy demonstrates stimulus generalization when he is bitten by a neighbor's boxer and then becomes afraid and runs away when he sees any neighborhood dog.*
    - *The same boy demonstrates stimulus discrimination if he still enjoys playing with his own family's pet collie.*

E. HIGHER-ORDER CONDITIONING

1. Higher-order conditioning or second-order conditioning occurs when a conditioned stimulus from one learning trial is paired with a new unconditioned stimulus. The new unconditioned stimulus becomes a new conditioned stimulus capable of eliciting the conditioned response even though it has never been paired with the unconditioned stimulus.

2. For example, Pavlov classically conditioned a dog to salivate to the sound of a ticking metronome. He then paired the ticking metronome with a black square. After several pairings of the ticking metronome and the black square, the black square produced salivation even though it had never been directly paired with food.

F. TASTE AVERSION AND CLASSICAL CONDITIONING

1. A classically conditioned dislike for and avoidance of a particular food that develops when an organism becomes ill after eating the food.
2. Many people have experienced vivid examples of taste aversion. For example, suppose you eat a pizza with a particularly spicy topping and then become ill with the flu. You then develop a dislike for the spicy topping and feel nauseated whenever you smell it. In this example, the flu sickness is the unconditioned stimulus and nausea is the unconditioned response. The spicy pizza topping is the conditioned stimulus and the nausea to the new food is the conditioned response.
3. While anecdotal examples are entertaining, they do not demonstrate a scientific cause-and-effect relationship. Psychologist John Garcia (b. 1917) conducted a series of controlled experiments to demonstrate that taste aversions could be produced in laboratory rats. In his basic experimental condition, Garcia first allowed rats to drink saccharin-flavored water (the neutral stimulus). A few hours later, he injected the rats with a drug (the unconditioned stimulus) that produced gastrointestinal distress (the unconditioned response). After recovering from the illness, the rats refused to drink the flavored water. Garcia concluded that the rats developed a taste aversion to the saccharin-flavored water.
4. Garcia's experiments challenged two basic principles of classical conditioning. First, the conditioning only required a single pairing. And second, instead of being separated by a few seconds, Garcia separated the two stimuli by several hours. Garcia's research thus demonstrated that there are important biological constraints on conditioning.

John Garcia's finding that animals develop an aversion for tastes associated with sickness has generated a number of multiple-choice questions. Be sure that you are familiar with Garcia's research findings and how they challenge basic principles of classical conditioning.

III. OPERANT CONDITIONING: INTRODUCTION

A. LIMITATIONS OF CLASSICAL CONDITIONING

1. Classical conditioning focuses on existing reflexive behaviors that are automatically elicited by a specific stimulus.
2. Learning, however, involves new behaviors or voluntary actions that classical conditioning cannot explain.

B. EDWARD L. THORNDIKE (1874–1949) AND THE LAW OF EFFECT

1. Animal behavior fascinated Edward L. Thorndike. His studies of baby chicks and cats were the first systematic investigations of animal learning.
2. Thorndike focused on how voluntary behaviors are influenced by their consequences. In his famous law of effect, Thorndike postulated that responses that lead to satisfying outcomes are more likely to be repeated. Similarly, responses followed by unpleasant outcomes are less likely to be repeated.

C. B.F. SKINNER (1904–1990) AND OPERANT CONDITIONING

1. B.F. Skinner was a renowned behaviorist who believed that psychologists should focus on observable behavior that could be objectively measured and verified.
2. During his long career, Skinner formulated the principles of operant conditioning. Skinner defined the term "operant" as any "active behavior that operates upon the environment to generate consequences." Operant conditioning is a learning process in which behavior is shaped and maintained by consequences (rewards or punishments) that follow a

response. In contrast, in classical conditioning behavior is controlled by the stimuli that precede a response.

IV. OPERANT CONDITIONING: REINFORCEMENT

A. BASIC DEFINITION OF REINFORCEMENT

1. Reinforcement occurs when a stimulus (the reinforcer) follows an active behavior or response.
2. The reinforcer increases the probability that the behavior or response will be repeated.

B. POSITIVE REINFORCEMENT

1. Definition
   - *A situation in which a behavior or response is followed by the addition of a reinforcing stimulus. The stimulus increases the probability that the response will occur again.*
   - *It is very important to understand that* positive *does not mean "good" or "desirable." Instead, Skinner used positive like a plus sign (+) to indicate that a response is strengthened because something is added.*
2. Examples
   - *Your performance in the school play is flawless (the operant). Your drama coach applauds and exclaims "Bravo!" (the reinforcing stimulus).*
   - *You make a special effort to help customers find the electronic products that will work best for them (the operant). Your boss gives you a raise to reward your hard work (the reinforcing stimulus).*
   - *You earn an A on your AP Psychology mid-term exam (the operant). Your teacher writes you an outstanding letter of recommendation (the reinforcing stimulus).*

C. NEGATIVE REINFORCEMENT

1. Definition
   - *A situation in which a behavior or response is followed by the removal of an adverse stimulus.*

- *It is very important to understand that* negative *does not mean "bad" or "undesirable." Instead, Skinner used negative like a minus sign (-) to indicate that a response is strengthened because something is subtracted or removed.*
- *Negative reinforcement typically enables you to either escape an existing aversive stimulus or avoid an aversive stimulus before it occurs.*

2. Examples
   - *You take out the garbage (the operant) to avoid your mother's repeated nagging (the aversive stimulus).*
   - *You put on sunscreen (the operant) to avoid getting sunburned (the aversive stimulus).*
   - *You give your little brother a candy bar (the operant) to prevent him from crying (the aversive stimulus).*
   - *Your little sister is crying (the operant). You hug her and she stops crying (the aversive stimulus).*

The AP Psychology Development Committee includes experienced classroom teachers who know that students easily understand positive reinforcement but have difficulty grasping negative reinforcement. As a result, AP Psychology exams usually have multiple-choice questions devoted to negative reinforcement. Remember, negative reinforcement increases the likelihood of a behavior by enabling you to either escape an existing aversive stimulus or avoid an aversive stimulus before it occurs.

D. THE PREMACK PRINCIPLE

1. Named after psychologist David Premack, the Premack principle states that the opportunity to engage in a preferred activity can be used to reinforce a less-preferred activity.
2. Examples
   - *You enjoy playing video games far more than studying for the SAT or ACT. Knowing this, you tie the less-preferred activity (studying for the SAT or ACT) to your preferred activity (playing video games).*

- *You enjoy eating ice cream for dessert far more than eating vegetables. Knowing this, your mother ties the less-desired activity (eating vegetables) to your preferred activity (eating ice cream).*

E. TYPES OF REINFORCERS

1. Primary reinforcers
   - *A reinforcer that is naturally reinforcing for a given species.*
   - *Food, water, shelter, and sexual contact are all primary reinforcers.*
2. Secondary reinforcers
   - *A reinforcer that gains its effectiveness by a learned association with primary reinforcers.*
   - *Money is the most widely used secondary reinforcer in human societies.*
3. Token economy
   - *A therapeutic method, based on operant conditioning, by which individuals are rewarded with tokens that act as secondary reinforcers. The tokens can be redeemed for rewards and privileges.*
   - *Elementary teachers often use token economies as a reinforcement strategy. The token economy enables a teacher to reinforce classroom rules without having to know a specific reinforcer for each student.*

F. CONTINUOUS REINFORCEMENT AND SHAPING

1. Continuous reinforcement
   - *A reinforcement schedule in which all correct responses are reinforced.*
   - *Responses extinguish faster when they are learned through a continuous reinforcement schedule.*
2. Shaping
   - *The technique of strengthening behavior by reinforcing successive approximations of a behavior until the entire correct routine is displayed.*
   - *Shaping is extensively used by athletic coaches and animal trainers.*

G. INTERMITTENT REINFORCEMENT

1. The rewarding of some, but not all, correct responses.
2. Advantages
   - *Intermittent reinforcement is the most efficient way to maintain behaviors that have already been learned.*
   - *Behaviors learned through intermittent reinforcement are very resistant to extinction. As a result, gambling is a very difficult habit to extinguish.*

H. RATIO SCHEDULES OF REINFORCEMENT

1. Ratio schedules are based upon the number of responses.
2. Fixed ratio schedules
   - *Reinforcement occurs after a predetermined set of responses.*
   - *An employer who pays workers for every three baskets of fruit they pick is using a fixed ratio schedule.*
   - *Fixed ratio schedules produce high response rates. However, there is a brief drop-off just after reinforcement.*
3. Variable ratio schedules
   - *Reinforcement is unpredictable because the ratio varies.*
   - *Casino owners use slot machines designed to operate on a variable ratio schedule.*
   - *Variable ratio schedules produce high response rates and are very resistant to extinction.*

I. INTERVAL SCHEDULES OF REINFORCEMENT

1. Interval schedules are based on responses made within a certain time period.
2. Fixed interval schedules
   - *Reinforcement occurs after a predetermined time has elapsed.*
   - *Employers who pay their workers every two weeks are using a fixed interval schedule of reinforcement. Teachers who give a test every two weeks are also using a fixed interval schedule.*
   - *Fixed interval schedules typically produce moderate response rates followed by a flurry of activity near the end of each interval.*

3. Variable interval schedules
    - *Reinforcement occurs unpredictably since the time interval varies.*
    - *Teachers who give pop quizzes are using a variable interval schedule.*
    - *Variable interval schedules produce low but steady response rates because respondents cannot predict when they will be rewarded.*

V. OPERANT CONDITIONING: PUNISHMENT

A. DEFINITION

1. Punishment is a process in which a behavior is followed by an aversive consequence that decreases the likelihood of the behavior being repeated.
2. Do not confuse punishment and reinforcement. Punishment decreases the likelihood of a behavior being repeated, while reinforcement increases the likelihood that the behavior will be repeated.

B. POSITIVE PUNISHMENT

1. The application or adding of an aversive stimulus after a response.
2. Examples
    - *You arrive late to work (the operant) and are reprimanded by your supervisor (the aversive stimulus).*
    - *You show off your knowledge of a subject by answering all of your teacher's questions (the operant) and a popular girl makes a snide remark about you (the aversive stimulus).*

C. NEGATIVE PUNISHMENT

1. The removal or subtraction of a reinforcing stimulus.
2. Negative punishment and negative reinforcement are easily confused. However, it is important to keep in mind that they are very different. Negative punishment makes a behavior less

likely to happen. In contrast, negative reinforcement makes a behavior more likely to happen.

3. Examples
   - *You arrive at work late (the operant) and are sent home without pay (the loss of a reinforcing stimulus).*
   - *You show off your knowledge of a subject by answering all your teacher's questions (the operant) and a popular girl doesn't invite you to her party (the loss of a reinforcing stimulus).*

D. DRAWBACKS OF PUNISHMENT

1. Punishment can produce undesirable results such as fear, hostility, and aggression.
2. Punishment often produces only a temporary change in behavior.
3. Punishment can produce a behavior pattern called learned helplessness. This occurs when a learner feels that it is impossible to escape punishment. This leads to a passive feeling of hopelessness that may lead to depression. For example, a student who is doing poorly in a difficult course may express a sense of learned hopelessness by saying, "No matter what I do I'm going to fail."

E. EFFECTIVE USES OF PUNISHMENT

1. Punishment should be delivered immediately after the offensive behavior.
2. Punishment should be certain.
3. Punishment should be limited and sufficient so that it "fits the crime."
4. Punishment should focus on the behavior, not the character, of the offender.

VI. COMPARING CLASSICAL CONDITIONING AND OPERANT CONDITIONING

A. PIONEERS

1. Classical conditioning—Ivan Pavlov and John B. Watson
2. Operant conditioning—Edward Thorndike and B.F. Skinner

B. TYPES OF BEHAVIOR

1. Classical conditioning—involuntary responses
2. Operant conditioning—voluntary responses

C. TIMING OF STIMULI

1. Classical conditioning—stimuli precede the response
2. Operant conditioning—stimuli follow the response

D. USE OF REWARDS AND PUNISHMENTS

1. Classical conditioning—does not use rewards and punishments
2. Operant conditioning—based upon rewards and punishments

VII. COGNITIVE PROCESSES

A. THE LIMITATIONS OF BEHAVIORIST THEORIES OF LEARNING

1. Behaviorists believe that classical and operant conditioning explain almost all learning.
2. However, cognitive psychologists believe that the behaviorists underestimate the importance of cognitive processes. They argue that cognitive or mental processes such as thinking and perception also play a key role in learning.

B. WOLFGANG KOHLER'S (1887–1967) STUDY OF INSIGHT

1. In a pioneering series of experiments Wolfgang Kohler suspended bananas just outside the reach of a caged chimpanzee named Sultan. Unlike Skinner's rats and pigeons,

Sultan did not solve the problem through trial-and-error. Instead, he studied the problem and in a flash of insight used a stick to knock down the fruit.

2. Kohler called this sudden understanding of a problem "insight learning." It is important to note that Sultan's behavior cannot be explained by either classical or operant conditioning.

C. EDWARD TOLMAN'S (1898–1956) STUDY OF LATENT LEARNING

1. In a classic study, Edward C. Tolman allowed one group of rats to run through a maze to obtain food. Tolman then allowed a second group of rats to explore the maze without receiving food. Some time later, Tolman compared the two groups to determine how quickly they could find the food at the end of the maze. Tolman reported that the second group of untrained rats found the food as quickly as the first group of trained rats.
2. Tolman explained his findings by hypothesizing that the untrained rats developed a cognitive map or mental representation of the maze. They then used this latent or hidden learning to rapidly find the food.
3. Remember that latent learning is not outwardly used until the situation calls for it.

VIII. OBSERVATIONAL LEARNING

A. DEFINITION

1. Observational learning occurs through watching others and then imitating or modeling the observed behavior.
2. Observational learning is also known as "social learning."

B. ALBERT BANDURA'S (B. 1925) CLASSIC BOBO DOLL STUDIES

1. Bandura and his colleagues allowed 4-year-old children to separately watch a live or televised adult model aggressively kick, punch, and shout at a large inflated Bobo doll. A second control group did not watch the aggressive models. Bandura

then allowed the children to play in a room with several toys, including a Bobo doll. The children who watched the live or televised aggressive model were much more likely to imitate the model's aggressive behavior than the children in the control group.

2. Bandura's experiment demonstrated the powerful influence of observational learning on behavior.

C. EXAMPLES

1. A high school basketball player attends a summer camp taught by college basketball players. The high school player returns home and incorporates some of their moves, trash talk, and training practices into his or her game.
2. Parents want to teach their five-year-old twins to share a bedroom. The parents model sharing behavior by demonstrating such cooperative behaviors as making the bed, hanging up clothes, and sweeping the floor.

Observational or social learning typically generates one multiple-choice question on each AP Psychology exam. However, in recent years observational learning has played a significant role in free-response questions. For example, both the 2002 and 2008 exams asked students to apply principles of observational learning to everyday situations.