Chapter 5: Learning

Courtesy Dr. Julie Gralow
LEARNING OBJECTIVES: Part 1

- LO 1 Define learning.
- LO 2 Explain what Pavlov’s studies teach us about classical conditioning.
- LO 3 Evaluate the differences between the US, UR, CS, and CR.
- LO 4 Recognize and give examples of stimulus discrimination and stimulus generalization.
- LO 5 Summarize how classical conditioning is dependent on the biology of the organism.
- LO 6 Evaluate the Little Albert study and explain how fear can be learned.
- LO 7 Describe Thorndike’s law of effect.
- LO 8 Explain shaping and the method of successive approximations.
- LO 9 Identify the differences between positive and negative reinforcement.
- LO 10 Distinguish between primary and secondary reinforcers.
LEARNING OBJECTIVES: Part 2

- LO 11 Describe continuous reinforcement and partial reinforcement.
- LO 12 Name the schedules of reinforcement and give examples of each.
- LO 13 Explain how punishment differs from negative reinforcement.
- LO 14 Summarize what Bandura’s classic Bobo doll study teaches us about learning.
- LO 15 Describe latent learning and explain how cognition is involved in learning.
In this Chapter

Although blind since the age of two, Ivonne Mosquera-Schmidt (left) has competed in over 20 triathlons.

Jeremy Lin’s (right) basketball success are the result of talent, motivation, and extensive learning.
LEARNING

Learning

- Relatively enduring change in behavior or thinking that results from experiences. Studies suggest that learning can begin before we are even born and continue until our dying day. The ability to learn is not unique to humans.

- Therapy animals like Emma help ease the stress of wounded veterans, abused children, cancer patients, and others suffering from psychological distress (American Humane Association, 2013). The dogs are trained using the principles of learning.
Habituation

- Basic form of learning evident when an organism does not respond as strongly or as often to an event following multiple exposures to it – apparent in a wide range of living beings, from humans to sea slugs. With repeated exposures, the stimulus is increasingly ignored and habituation occurs.

Stimulus

- Event or occurrence that generally leads to a response.
THREE TYPES OF LEARNING

Classical conditioning
- Through *classical conditioning*, we associate two different stimuli: for example, the sound of a bell and food.
- Two different stimuli are associated

Operant conditioning
- In *operant conditioning*, we make connections between our behaviors and their consequences: for example, through rewards and punishments.
- Connections between behaviors and consequences are made

Observational learning
- We learn by watching and imitating other people, establishing a closer link between our behavior and the behavior of others.
- Learning occurs by watching and imitating others
1. Learning is a relatively enduring change in behavior or thinking that results from our experiences.

2. Learning can often be described as the creation of _______, for example, between two stimuli or between a behavior and its consequences.
   a. habituation
   b. ethical dilemmas
   c. associations
   d. unexpected events
PAVLOV

Pavlov spent the 1890s studying the digestive system of dogs at Russia’s Institute of Experimental Medicine (Watson, 1968). One of his experiments involved measuring how much dogs salivate in response to food.

After repeated trials with an assistant giving a dog its food and then measuring the dog’s saliva output, Pavlov noticed that instead of salivating the moment it received food, the dog began to salivate at the mere sight or sound of the lab assistant arriving to feed it. The assistant’s footsteps seemed to act like a trigger (the stimulus) for the dog to start salivating (the response).

The dog was associating the sound of footsteps with the arrival of food; it had been conditioned to associate the sights and sounds of eating. The dog had learned to salivate when exposed to these stimuli, much like you might respond when seeing a sign for a favorite restaurant or a dessert you like.

Dogs began salivating to other stimuli as well.
Pavlov studied the link between stimulus (the sound of human steps) and response (the dog’s salivation).

The type of behavior he was studying (salivating) was not voluntary; it was involuntary or reflexive (Pavlov, 1906).

The connection between food and salivating is innate or universal, whereas the link between the sound of footsteps and salivating is learned.

Learning had occurred whenever, a new, nonuniversal link between stimulus (footsteps) and response (salivation) is established.
Pavlov used a variety of stimuli, such as sounds from a metronome, a buzzer, and the tone of a bell, which under normal circumstances have nothing to do with the food. In other words, they are neutral stimuli in relation to food and responses to food.
A typical Pavlovian experiment using the tone of a bell and meat powder went something like this: A dog was placed alone in a soundproofed room and outfitted with equipment designed to keep it from moving around. On numerous occasions during an experimental trial, Pavlov and his assistants presented the dog with the sound of the tone, and then moments later gave the dog some meat powder. Each time the tone was sounded, the assistant would wait a couple of seconds and then offer the dog meat powder. The procedure resulted in learning because after repeating the tone – food pairing several times, when only the sound of the tone was played, with no meat powder nearby, the dog salivated anyway. The dog had been conditioned to associate the sound of the tone with food.
PAVLOV

Initially Pavlov’s dogs to associate with his assistant’s footsteps.

Pavlov then conditioned his dogs to salivate in response to auditory stimuli, such as bells, tones, and ticking metronomes.

A metronome is a device that musicians often use to maintain tempo.
• **Neutral stimulus** – something in the environment that *does not* normally cause a relevant *automatic* or reflexive response.

• Salivation is the relevant automatic response associated with food; dogs do not normally respond to the sound of a tone by salivating. But through experience, the dogs learned to link this neutral stimulus (the tone) with another stimulus (food) that prompts an automatic unlearned response (salivation).

• This type of learning is **classical conditioning**, which occurs when an originally neutral stimulus is conditioned to *elicit* or induce an involuntary response, such as salivation, eye blinks, and other types of *reflex* reactions.
<table>
<thead>
<tr>
<th>Neutral stimulus</th>
<th>Classical conditioning</th>
<th>Acquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulus that does not cause a relevant automatic or reflexive response</td>
<td>Learning process in which two stimuli become associated with each other when an originally neutral stimulus is conditioned to elicit an involuntary response</td>
<td>The initial learning phase in both classical and operant conditioning</td>
</tr>
</tbody>
</table>
Classical Conditioning: Part 3

Unconditioned stimulus (US)
- Stimulus that automatically triggers an involuntary response without any learning needed

Unconditioned response (UR)
- Reflexive, involuntary response to an unconditioned stimulus
Classical Conditioning: Part 4

Conditioned stimulus (CS)
- Previously neutral stimulus that an organism learns to associate with an unconditioned stimulus

Conditioned response (CR)
- Learned response to a conditioned stimulus
Learning Through Classical Conditioning: Part 1

Pavlov’s Experiment

Before conditioning:
- Dog salivates automatically when food is presented.
- Unconditioned stimulus: food
- Unconditioned response: salivates

After conditioning:
- Bell means nothing to dog, so there is no response.
- Neutral stimulus: ringing bell
- No response

Involves repeated pairings of the two stimuli.
Learning Through Classical Conditioning: Part 2

During conditioning
In the process of conditioning, bell is repeatedly played right before dog receives food. Over time, dog learns that bell signals arrival of food.

Neutral stimulus (ringing bell) + Unconditioned stimulus = Unconditioned response (salivates)

repeated over time

After conditioning
Dog has now learned to associate bell with food and will begin salivating when bell rings.

Conditioned stimulus (ringing bell) → Conditioned response (salivates)
Have YOU been conditioned?
NUTS AND BOLTS OF CLASSICAL CONDITIONING

Stimulus generalization

- After association is forged between CS and CR, learner often responds to similar stimuli as if they are the original CR.

Stimulus discrimination

- Ability to differentiate between a particular CS and other significantly different stimuli is stimulus differentiation.
NUTS AND BOLTS OF CLASSICAL CONDITIONING

Extinction
- If the CS is presented time and again without being accompanied by the US, the association may fade.
- The CR decreases and eventually disappears in a process called extinction.

Spontaneous recovery
- With presentation of a CS after a rest period, the CR may reappear.
- The CR was not forgotten, but suppressed during the extinction.
Higher Order Conditioning

When a second neutral stimulus is paired with a CS instead of being paired with the original US, higher order conditioning occurs.
YUCK: CONDITIONED TASTE AVersion

Conditioned taste aversion
- Involves powerful form of classical conditioning
- Occurs when organism learns to associate taste of particular food or drink with illness
- May have adaptive value

Garcia and his rats
- Investigated how rats responded to eating and drinking foods associated with sickness
- Demonstrated that rats linked sick feelings with tastes and smells

How does the rats’ behaviors illustrate adaptive behavior?
Australia’s northern quoll (left) is threatened by the introduction of an invasive species known as the cane oad (right). The quolls eat the toads, which carry a lethal dose of poison, but they can learn to avoid this prey through conditioned taste aversion.
AN UNUSUAL FLAVOR TRAINS THE BRAIN TO DAMPEN THE IMMUNE SYSTEM

- In the 1970s, researchers discovered that with repeated conditioning an animal’s immune system could be used to associate a taste with an immunosuppressive drug.
- In 2002, results of a small study indicated that learned immunosuppression could be recalled more than once in humans.

Why was this an important finding?
How was classical conditioning used to create Little Albert’s fear of rats?

Little Albert was an 11-month-old baby who developed a fear of rats through his participation in an ethically questionable experiment by John B. Watson and Rosalie Rayner (Watson & Rayner, 1920).
Classical Conditioning: Can You Provide Examples Of Excepted Responses?

Part 1

<table>
<thead>
<tr>
<th>Type</th>
<th>Pairing of Neutral and US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertising</td>
<td>Repeated pairing of products such as automobiles (neutral stimulus) with celebrities (US)</td>
</tr>
<tr>
<td>Fears</td>
<td>Pairing of a dog lunging (US) at you on the street (neutral stimulus) where you take your morning run One pairing of seeing a car in the rear- view mirror (neutral stimulus) and being rear-ended by that car (US)</td>
</tr>
</tbody>
</table>
Classical Conditioning: Can You Provide Examples Of Excepted Responses?  
Part 2

<table>
<thead>
<tr>
<th>Type</th>
<th>Pairing of Neutral and US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fetishes</td>
<td>Repeated pairings of Originally nonsexual objects like shoes (neutral stimuli) and sexual activity (US)</td>
</tr>
<tr>
<td>Romance</td>
<td>Repeated pairings of a cologne (neutral stimulus) with your romantic partner (US)</td>
</tr>
</tbody>
</table>
Try This: Part 1

CLASSICAL CONDITIONING: DO YOU BUY IT?

Classical conditioning is used in marketing to instill positive emotions and attitudes toward product brands.

List examples of recent advertisements you have seen on television or the Internet that use this approach to get people to buy products.

Which of your recent purchases were influenced by this type of ad?
1. A mother takes her 2-year-old son to the doctor for immunizations. The child sees a nurse approaching with a stethoscope around her neck. She gives him a shot and he automatically starts crying. After that, every time the boy sees anyone wearing a stethoscope, he starts to cry. Which is the conditioned stimulus?

   a. the shot
   b. crying
   c. the stethoscope
   d. the mother

2. Because of biological preparedness, animals and people are predisposed or inclined to form associations that increase their chances of survival.
Show What You Know: Part 3

3. Hot dogs were once your favorite food, but ever since you ate a foot-long hot dog tainted with salmonella (which causes food poisoning), you cannot smell or taste one without feeling nauseous. Which is the unconditioned stimulus?

a. salmonella  
b. nausea  
c. hotdogs  
d. the hotdog stand
4. Watson and Rayner used classical conditioning to instill fear in Little Albert. Create a diagram of the neutral stimulus, US, UR, CS, and CR used in their experiment with Little Albert.

When little Albert heard the loud bang, it was an unconditioned stimulus (US) that elicited fear, the unconditioned response (UR). Through conditioning, the sight of the rat became paired with the loud noise, and thus the rat went from being a neutral stimulus to a conditioned stimulus (CS). Little Albert’s fear of the rat became a conditioned response (CR).
OPERANT CONDITIONING

Operant conditioning

- Involves learning that occurs when voluntary actions become associated with their consequences
Operant Conditioning and the Law of Effect

Early psychologist Edward Thorndike conducted his well-known cat experiments using “puzzle boxes” like the one shown here. At the start of the experiment, Thorndike’s cats pawed around haphazardly until they managed to unlatch the cage and then eat the fish treats outside the door. As the trials wore on, the felines learned to free themselves more and more quickly. After several trials, the amount of time needed to escape the box dropped significantly (see graph above). Thorndike attributed this phenomenon to the law of effect.
Operant Conditioning and Skinner

Radical behaviorist

American psychologist B. F. Skinner is one of the most influential psychologists of all time. Skinner believed that every thought, emotion, and behavior (basically anything psychological) is shaped by factors in the environment.
Learning through Operant Conditioning

Operant conditioning is a type of learning in which we associate our voluntary actions with the consequences of those actions.

B. F. Skinner showed that operant conditioning could do more than elicit simple, isolated actions. Through the process of shaping, in which reinforcers are used to change behaviors toward a more complex behavior, Skinner taught his pigeons to perform behaviors involving a series of actions, like bowling and tennis. Today, shaping is used routinely by parents, teachers, coaches, and employers to train all kinds of complex behaviors.
Skinner's Experiment: Train A Pigeon to Play Tennis

Pigeon is rewarded with seeds for pecking the ball.

Ball-pecking behavior increases.

Now only the next step toward “tennis” is rewarded.
Ball-pushing behavior increases

After behavior has been shaped through reinforcement, the pigeon has learned to play tennis.
CHICKENS CAN’T PLAY BASEBALL

Keller and Marian Breland trained 6000 animals not only to boogie but also to vacuum, dine at a table, and play sports and musical instruments. But could not coax a chicken to play baseball.

How did the Brelands explain this finding?
## Conditioning Basics

### Table 5.2  CONDITIONING BASICS

<table>
<thead>
<tr>
<th>Term</th>
<th>Classical Conditioning</th>
<th>Operant Conditioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Link</td>
<td>Links different stimuli, often through repeated pairings.</td>
<td>Links behavior to its consequence, often through repeated pairings.</td>
</tr>
<tr>
<td>Response</td>
<td>Involuntary behavior.</td>
<td>Voluntary behavior.</td>
</tr>
<tr>
<td>Acquisition</td>
<td>The initial learning phase.</td>
<td>The initial learning phase.</td>
</tr>
<tr>
<td>Extinction</td>
<td>The process by which the conditioned response decreases after repeated exposure to the conditioned stimulus in the absence of the unconditioned stimulus.</td>
<td>The disappearance of a learned behavior through the removal of its reinforcer.</td>
</tr>
<tr>
<td>Spontaneous Recovery</td>
<td>Following extinction, with the presentation of the conditioned stimulus after a rest period, the conditioned response reappears.</td>
<td>Following extinction due to the absence of reinforcers, the behavior reemerges in a similar setting.</td>
</tr>
</tbody>
</table>

These fundamental learning concepts apply to both classical and operant conditioning.
Operant Conditioning: Acquisition to Extinction

**Stimulus generalization and discrimination**

- Occurs when previously learned response to one stimulus occurs in the presence of a similar stimulus
- With the use of reinforcers, humans (and animals) learn to discriminate.
REINFORCEMENT

Positive reinforcement
- Occurs when reinforcers are added or presented following the target behavior

Negative reinforcement
- Involves the removal of an unpleasant stimulus following a target behavior (this increases the likelihood it will occur again)
REINFORCEMENT

There are two major categories of reinforcers.

**Primary**
- Satisfies a biological need
- Innate

**Secondary**
- Does not satisfy biological needs
- Effectiveness often tied to association with primary reinforcers
- May be seen in social interactions
CONTAGIOUS BEHAVIORS

Centola found that people are more likely to explore healthy behaviors like those in their social media networks.

This is especially true for those in clustered networks where people share the same contacts.

Do the people in your clustered networks have healthy lifestyles?
When Ivonne started running in 2001, her friends reinforced her with hot chocolate. These days, she doesn’t need sweet treats to keep her coming back. The pleasure she derives from running is reinforcement enough. Ivonne runs tethered to her husband, G. John Schmidt. She sets the pace, while he warns her of any changes in terrain, elevation, and direction.
### Operant Conditioning: Part 3

<table>
<thead>
<tr>
<th>Continuous reinforcement</th>
<th>Partial reinforcement</th>
<th>Partial reinforcement effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Occurs when reinforcer is presented every time a behavior is produced</td>
<td>- Occurs when reinforcer is delivered intermittently</td>
<td>- Tendency for behaviors acquired through intermittent reinforcement to be more resistant to extinction than those acquired through continuous reinforcement.</td>
</tr>
<tr>
<td>- Can be used in variety of settings</td>
<td>- Very effective in maintaining behavior</td>
<td></td>
</tr>
<tr>
<td>- Works best for establishing new behaviors during acquisition</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
REINFORCEMENT SCHEDULES

Continuous reinforcement is ideal for establishing new behaviors. But once learned, a behavior is best maintained with only partial reinforcement.

Partial reinforcement can be delivered according to four different schedules of reinforcement.

Let’s take a closer look on the next slides.
Notice that fixed-interval and fixed-ratio graphs demonstrate a characteristic dip in the reinforced behavior after each reinforcement, as the learner seems to anticipate that reinforcement won’t follow immediately.
Variable-ratio schedule: Schedule in which number of desired responses or behaviors that must occur before a reinforcer is given changes across trials and is based on an average number of responses to be reinforced.
Fixed-interval schedule: Schedule in which reinforcer comes after a pre-established interval of time goes by.

The response or behavior is only reinforced after the given interval is over.
Goal of punishment is to decrease or stop a behavior.

Goal of reinforcement is to make a behavior more likely to recur.
Behavior: Driving Fast Part 1

Learning: Punishment and Reinforcement

Do you want to increase this behavior?

NO
Behavior: Driving Fast Part 2

Learning: Punishment and Reinforcement

Do you want to increase this behavior?

YES
Operant Conditioning: Categories of Punishment

Positive punishment
- Addition of something unpleasant following an unwanted behavior, with the intention of decreasing that behavior.

Negative punishment
- Removal of something desirable following an unwanted behavior, with the intention of decreasing that behavior.
Controversies

SPOTLIGHT ON SPANKING

- About two-thirds of American parents use physical punishment
- Spanking often provides a fast-action fix, but its consequences may be long-lasting.
- What do you think?
Sending a child to a corner for a “time-out” is an example of negative punishment because it involves removing something (the privilege to play) in order to decrease an unwanted behavior.

Spanking is a positive punishment because it involves the addition of something (a slap on the bottom) to discourage an undesirable behavior.
### Table 5.3 REINFORCEMENT VERSUS PUNISHMENT

<table>
<thead>
<tr>
<th>Term</th>
<th>Defined</th>
<th>Goal</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positive Reinforcement</strong></td>
<td>Addition of a pleasant stimulus following a target behavior</td>
<td>Increase desired behavior</td>
<td>Students who complete an online course 15 days before the end of semester receive 10 points of extra credit.</td>
</tr>
<tr>
<td><strong>Negative Reinforcement</strong></td>
<td>Removal of an unpleasant stimulus following a target behavior</td>
<td>Increase desired behavior</td>
<td>Students who have perfect attendance for the semester do not have to take the final exam.</td>
</tr>
<tr>
<td><strong>Positive Punishment</strong></td>
<td>Addition of something unpleasant following an unwanted behavior</td>
<td>Decrease undesired behavior</td>
<td>Students who are late to class more than two times have to write an extra paper.</td>
</tr>
<tr>
<td><strong>Negative Punishment</strong></td>
<td>Removal of something pleasant following an unwanted behavior</td>
<td>Decrease undesired behavior</td>
<td>Students late to class on exam day are not allowed to use their notes when taking the exam.</td>
</tr>
</tbody>
</table>

The positive and negative forms of reinforcement and punishment are easy to confuse. Above are some concrete definitions, goals, and examples to help you sort them out.
What is the difference?

**Classical Conditioning**
- Involuntary (learner's response is reflexive)
- Learn to link different stimuli
- Through repeated pairing of stimuli

**Operant Conditioning**
- Voluntary (learner controls response)
- Learn to link consequence with behavior
- Through repeated pairing of consequence and behavior

**Nature of Behavior**

**Association**

**Strengthening Behavior**
1. According to Thorndike and the law of effect, if a behavior is followed by a pleasurable outcome, the likelihood that the behavior will happen again increases.

2. A third-grade teacher gives her students prizes for passing math tests. Not only do the students improve their math scores, they also begin to study more to improve their spelling scores as a result of this reinforcement schedule. Their increased studying of spelling is a good example of:
   a. classical conditioning.
   b. an unconditioned response.
   c. an unconditioned stimulus.
   d. stimulus generalization.
3. A child disrupts class and the teacher writes her name on the board. For the rest of the week, the child does not act up. The teacher used to decrease the child’s disruptive behaviors.

a. *positive punishment*
b. negative punishment
c. positive reinforcement
d. negative reinforcement
4. Think about a behavior you would like to change (either yours or someone else’s). Devise a strategy using positive and negative reinforcement to change that behavior. Also contemplate how you might use successive approximations. What reinforcers would you use? Answers will vary, but can be based on the following definitions. Reinforcers are consequences that increase the likelihood of a behavior reoccurring. Positive reinforcement is the process by which pleasant reinforcers are presented following a target behavior. Negative reinforcement occurs with the removal of an unpleasant stimulus following a target behavior. Successive approximation is a method for shaping that uses reinforcers to condition a series of small steps that gradually approach the target behavior.
Playing for the Houston Rockets, Jeremy works the offense against the Brooklyn Nets. He may not be the tallest player in the NBA, but he more than makes up for that in confidence and game smarts.

Baby Jeremy poses with his father Gie-Ming, a basketball aficionado who learned the game by studying NBA greats like Kareem Abdul-Jabbar and Larry Bird.
THE POWER OF OBSERVATIONAL LEARNING

Bandura and the classic Bobo doll experiment

- Bandura and colleagues revealed the speed with which children adopted aggressive behaviors modeled by adults.

Let’s look at a few of these in the next slide.
Try This: Part 2

Identify the independent variable and dependent variable in the experiment carried out by Bandura and colleagues.

What might you change if you were to replicate or duplicate this experiment?
THE POWER OF OBSERVATIONAL LEARNING

Violence in the media

- The American Academy of Pediatrics statement: “Extensive research evidence indicates that media violence can contribute to aggressive behavior, desensitization to violence, nightmares, and fear of being harmed.” (American Academy of Pediatrics, 2009, p. 1495)
- What cautions do the critics suggest?
Prosocial behavior and observational learning

The prosocial behaviors demonstrated by Big Bird and Sesame Street friends appear to have a meaningful impact on child viewers. Children have a knack for imitating positive behaviors such as sharing and caring. (Cole et al., 2008)
LEARNING AND COGNITION: A MAP THAT CANNOT BE SEEN

- **Cognitive map**
  - Involves a mental layout
  - Provides spatial representation to aid in navigation of environment
  - Are created through latent learning that occurs without awareness and regardless of reinforcement
Latent Learning

- In a classic experiment, groups of rats learned how to navigate a maze at remarkably different rates.
- After looking at the figure on the right, can you tell how the reinforcement affected the rats’ performance?
1. You want to learn how to play basketball, so you watch videos of Jeremy Lin executing plays. If your game improves as a result, this would be considered an example of:
   a. observational learning.
   b. association.
   c. prosocial behavior.
   d. your cognitive map.

2. Observational learning results in a wide variety of learned behaviors. Describe several types of behaviors you have learned through observation of a model.
   Answers will vary, but can be based on the following definitions. A model is an individual or character whose behavior is being imitated. Observational learning occurs as a result of watching the behavior of others.
Show What You Know: Part 8

3. Although Skinner was a strong advocate for the theory that reinforcement is the cause of learning, there is robust evidence that reinforcement is not always necessary. This comes from experiments studying:

a. positive reinforcement.

b. negative reinforcement.

c. latent learning.

d. stimulus generalization.