Chapter 6
Learning

- **Learning** is defined as any relatively permanent change in behavior that is based upon experience.
- It is an area of psychology that seems simple to evaluate but is in fact quite complex.
- Factors both within and outside of an organism can influence and interfere with learning.

**Behaviorism**
- Behaviorists are psychologists who insist that psychologists should study only observable, measurable behaviors, not mental processes.
- There is however a wide range of views among researchers who call themselves behaviorists.
- **The Rise of Behaviorism**
  - Jacques Loeb argued that all animal behavior, and most human behavior, could be explained with stimulus-response psychology.
  - Stimulus-response psychology attempts to explain behavior in terms of how each stimulus triggers a response.
  - Flinching away from a blow and shading one’s eyes from a strong light would be examples of stimulus-response behaviors.
  - More complex patterns of behavior are just the result of adding together many changes of speed and direction elicited by various stimuli.
  - Modern behaviorists do not subscribe to this model but now believe that behavior is the product of a history of stimuli and responses, plus the effects of natural physiological states (hunger, tiredness, etc.)

**Pavlov and Classical Conditioning**
- Ivan Pavlov was a physiologist who won a Nobel Prize for his research on digestion.
- His original description of classical conditioning was a by-product of this research. He did not set out to discover classical conditioning.

**Classical Conditioning**
- Pavlov noticed that the dogs he used to do his research salivated upon the sight of the lab workers who fed them.
  - He concluded that this reflex was “psychological” because it was based on the dog’s previous experiences.
  - Further testing demonstrated that the sight of food produced the same effect as giving the same amount of food to the dog.
- Based upon his tentative acceptance of the salivation as a reflex, Pavlov used the term **conditional reflex** to describe this response.
- The term was mistranslated into English as **conditioned reflex**, a mistake that helped create the terminology we use to describe classical conditioning.
- Pavlov started with the **unconditioned reflex** of salivation to food. He hypothesized that this was an automatic connection.
- The dogs had an unconditioned reflex between food and secretion of digestive juices.
- A buzzer is called a **neutral stimulus** because it elicits attention to the sound, but no automatic connection.
  - The dogs would lift their ears and look around when the buzzer sounded, but no salivation was produced.
- He conjectured that animals develop new connections by transferring a response from one stimulus to another.
  - He hypothesized that if a buzzer always preceded the food, the buzzer would begin to elicit the reflex of salivation.
- After a few pairings of the buzzer with the food, the dogs would begin to salivate as soon as the buzzer sounded.

### Terminology

- **Unconditioned Stimulus (UCS)** → An event that consistently and automatically elicits and unconditioned response.
- **Unconditioned Response (UCR)** → An action that the unconditioned stimulus automatically elicits.
- **Conditioned Stimulus (CS)** → Formerly the neutral stimulus, having been paired with the unconditioned stimulus, elicits the same response. That response depends upon its consistent pairing with the UCR.
- **Conditioned Response (CR)** → The response elicited by the conditioned stimulus due to the training. Usually it closely resembles the UCR.

### Factors that enhance conditioning

- Conditioning occurs more rapidly when the conditioned (neutral) stimulus is relatively unfamiliar. If you are already habituated to (used to) the neutral stimulus, it will take longer for its pairing with an unconditioned stimulus to form a connection for you.
- Conditioning is facilitated when people are already aware of the connection between the CS and the UCS. When people are informed of the conditioning procedure prior to its beginning, they will be conditioned faster.

### The Phenomena of Classical Conditioning

- The process that establishes or strengthens a conditioned response is called **acquisition**.
- To extinguish a classically conditioned response, the conditioned stimulus is repeatedly presented without the unconditioned stimulus. This decrease and elimination is referred to as **extinction**.
- A rabbit is conditioned to blink its eye through repeated presentation of a musical tone followed by a puff of air directly blown in its eye. After a few repetitions, the rabbit blinks its eye when the tone sounds. This is the **Acquisition**.
- The musical tone is then played repeatedly with no puff of air. Gradually, the rabbit stops blinking its eye. This is the **Extinction**.
- Extinction does not erase the association between the CS and the UCS.
If the puff of air is suddenly presented again to the rabbit without warning, it will blink its eye the next time the tone is played.

The temporary return of an extinguished response is called spontaneous recovery.

The rabbit acquires the response, and then the response is extinguished through the repeated presentation of the tone with no air puff. Many hours after the experiment, the rabbit hears a musical tone. It blinks its eye.

Stimulus generalization is the extension of a conditioned response from the training stimulus to similar stimuli.

Through conditioning Baby Hannah smiles and laughs at the title screen with dark background and white writing that precedes a funny song and cartoon on her “Merrytubbies” video tape. Her parents notice that she also smiles and giggles at the FBI Warning screen appearing on movie videotapes.

Discrimination is the process of learning to respond differently to two stimuli because they produce two different outcomes.

Gradually Hannah stops laughing at the FBI Warning screen because the song and cartoon do not follow it.

Explanations of Classical Conditioning

The process of classical conditioning is more complex than it seems at first glance.

The association is not merely a transfer of response from one stimulus to the other. The conditioned stimulus appears to act as a signal to the organism.

Temporal contiguity facilitates the process of conditioning. The less time elapses between the presentation of the CS and the UCS, the faster the CR is acquired.

The CR will be acquired more quickly when the CS precedes the UCS. This is called forward conditioning.

In trace conditioning, the CS stops well before the UCS is presented. This is a slow and relatively ineffective way to condition a response.

Backward conditioning (UCS follows by the CS) rarely produces any response.

The discovery of blocking effects suggests that it is difficult to condition the same response in an animal to more than one stimulus.

When rats experience an electric shock (a UCS) they jump and shriek.

After being conditioned to a buzzer preceding the shock (a CS) they freeze in place at the sound of the buzzer. This is known to be a typical rat response to imminent danger.

These findings suggest that an animal uses a CS as a way to prepare for a UCS. The animal is not treating the CS as the actual UCS.

Conditioning, Contiguity and Contingency

A conditioned response develops only if there is predictability or contingency.

The UCS is more likely after the CS than without it.
The learner discovers the event that predicts the outcome. However, it is unclear whether or not any actual complex thinking is occurring as a result of this process.

- Classical conditioning is thought by those unfamiliar with psychology to be the learning of simple, mechanical behavior.
- In reality it is a complex form of learning that requires some processing of information on the part of the learner.

**Thorndike and Operant Conditioning**

- In 1911, Harvard graduate student Edward Thorndike developed a simple, behaviorist explanation of learning.
- He used a learning curve, a graph of the changes in behavior that occur over successive trials of a learning experiment, to record how quickly cats learned to escape from a puzzle box (a type of maze.)
- The curve of learning for the cats indicated a slow, gradual and consistent progress towards the solution.
- He noted that cats would learn to escape from puzzle boxes more quickly if the response selected produced an immediate escape.
- The cats would try a repertoire of behaviors to open the box, and gradually learn to more quickly select the one that produced escape.
- But overall, it appeared to Thorndike that the cats were not "understanding" the connections between the solution and the escape. There was no sudden increase in the learning curve to support that assumption.
- Thorndike observed that the escape from the box acted as a reinforcement for the behavior that led to the escape.
  - A **reinforcement** is an event that increases the future probability of the most recent response.

**Thorndike's Law of Effect**

- "Of several responses made to the same situation, those which are accompanied or closely followed by satisfaction to the animal will, other things being equal, be more firmly connected to the situation, so that, when it (the situation) recurs, they will be more likely to recur."

**Operant Conditioning**

- The type of learning that Thorndike studied has come to be known as operant or instrumental conditioning.
  - **Operant conditioning** is the process of changing behavior by following a response with a reinforcement.
  - In operant conditioning, the subject's behavior determines an outcome and is affected by that outcome.
  - Classical conditioning is distinguished from operant conditioning in that the subject's behavior has no effect on the outcome.
  - Classical conditioning usually influences visceral, reflexive, and involuntary responses, while operant conditioning applies to skeletal, somatic, and voluntary responses.
• Extinction
• Stimulus generalization
• Discrimination
• Discriminative stimulus
• Stimulus control

Phenomena of Operant Conditioning
• In operant conditioning, **extinction** occurs if responses stop producing reinforcements.
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• **Stimulus generalization** occurs when a new stimulus is similar to the original reinforced stimulus. The more similar the new stimulus is to the old, the more strongly the subject is likely to respond.
• **Discrimination** occurs when someone is reinforced for responding to one stimulus but not another. The individual will respond more vigorously to one than to the other.
• A stimulus that indicates which response is appropriate or inappropriate is called a **discriminative stimulus**.
• The ability of a stimulus to encourage some responses and discourage others is known as **stimulus control**.

B.F. Skinner and the Shaping of Behavior
• B.F. Skinner is considered to be the most influential of all radical behaviorists.
• He demonstrated many potential applications of operant conditioning.
• He was a firm believer in parsimony, seeking simple explanations in terms of reinforcement histories, and avoiding the inference of complex mental processes.

Shaping Behavior
• Shaping establishes new responses by reinforcing successive approximations to it.
• He used an "**operant chamber**" (referred to as a "Skinner box" by others) into which he put the animal he wished to train by shaping.
• Gradually the animal was reinforced for behaviors that approached the desired activity until it actually performed the behavior in full.
• For example, to make a pigeon turn in a complete clockwise circle, Skinner would first reinforce the pigeon with food for just turning a few degrees to the right. After the pigeon began turning to the right regularly, he would cease reinforcing until the pigeon turned a few more degrees in that direction, and when that behavior was established, wait until the pigeon turned more pronouncedly to the right, and reinforce that movement, until finally the pigeon turned completely around in a circle.

Chaining Behavior
• **Chaining** is an operant conditioning method where behaviors are reinforced by opportunities to engage in the next behavior
  • The animal learns the final behavior, and then the next to last, and so on, until the beginning of the sequence is reached.
Increasing and Decreasing the Frequency of Responses

- **A reinforcement** is an event that increases the probability that a response will be repeated.
- **A punishment** is an event that decreases the probability of a response.

Reinforcement and Punishment

- A reinforcement can be either the presentation of a desirable item such as money or food (positive), or the removal of an unpleasant stimulus (negative), such as verbal nagging or physical pain.
- A punishment can be the removal of a desirable condition such as driving privileges (negative) or the presentation of an unpleasant condition such as physical pain (positive).
  - All things being equal, most people will respond better to both immediate reinforcement and immediate punishment.
  - Many behaviors are immediately reinforcing, while the punishments is delayed and uncertain.
  - Punishment tends to be ineffective.
- The presentation of an event that strengthens or increases the likelihood of an event is called positive reinforcement.
- Escape learning or active avoidance learning occurs if the responses lead to an escape from or an avoidance of something painful.
  - This is sometimes referred to as **negative reinforcement**.
- Punishment is referred to as passive avoidance learning because in response to punishment an individual learns to avoid the outcome by being passive.
- Omission training occurs when the omission of the response produces reinforcement. Producing the response also leads to a lack of reinforcement.
  - This is sometimes referred to as **negative punishment**.

What Constitutes Reinforcement?

- A reinforcer is something that increases the likelihood of the preceding response.
  - This can be confusing because it leads to a circular explanation.
  - It can also be confusing because although generally a reinforcer is a pleasant event, it doesn’t have to be.
  - What constitutes a “pleasant event” can be hard to define or vary from person to person.
- Many reinforcers satisfy biological needs, such as hunger.
- Some reinforcers don’t satisfy any immediate need (secondary), but may represent a future opportunity to have greater access to resources (such as a good grade – you can’t eat it, but getting many of them may raise your chances of having more to eat later in your life.)
Unconditioned reinforcers meet primary, biological needs and are found to be reinforcing for almost everyone. Food and drink are unconditioned reinforcers. (Primary)

Conditioned reinforcers are effective because they have become associated with unconditioned reinforcers. Money and grades are conditioned reinforcers. (Secondary)

Schedules of Reinforcement

A schedule of reinforcement is a set of rules of procedures for delivery of reinforcement

- It is used to maintain a learned behavior that might be extinguished if reinforcement ceased.
- A continuous reinforcement schedule provides reinforcement every time a response occurs.
- However, outside of the laboratory, reinforcement rarely follows every occurrence of a desired behavior.

Most schedules of reinforcement are intermittent. In other words, some responses are reinforced and others are not.

One of the two major categories of intermittent reinforcement is ratio, in which the delivery of reinforcement depends on the number of responses given by the individual.

The second category of intermittent reinforcement is interval, in which delivery of reinforcement depends on the amount of time that has passed since the last reinforcement.

A fixed-ratio schedule provides reinforcement only after a certain (“fixed”) number of correct responses have been made. For example, a laboratory rat being reinforced for hitting a lever after every 5 hits is being reinforced on an FR-5 schedule.

A variable-ratio schedule provides reinforcement after a variable number of correct responses, usually working out to an average in the long run. For example, a baseball player who has a .333 batting average is reinforcing fans with hits on a VR-3 schedule.

A fixed-interval schedule provides reinforcement for the first response made after a specific time interval. A person who is paid every two weeks is reinforced for work on a fixed interval schedule.

A variable-interval schedule provides reinforcement after a variable amount of time has elapsed.

All things being equal, extinction of responses tends to take longer when an individual has been on an intermittent schedule rather than a continuous schedule.

One explanation for this difference is that the lack of reinforcement does not signify the completion cessation of reinforcements to the individual who has been on an intermittent schedule.
Applications of Operant Conditioning

- There are a wide variety of applications for the techniques of operant conditioning including, but not limited to
  - Animal training for performance, military, and helper animals.
  - Persuasion in political and commercial enterprises.
  - Psychological treatment, through the use of applied behavior analysis or behavior modification.

- In behavior modification, the clinician determines which reinforcers sustain an undesirable or unwanted behavior.
- The clinician then tries to change the behavior by reducing the opportunities for reinforcement of the unwanted behavior and providing reinforcers for a more acceptable behavior.

Operant Conditioning

- People are sometimes offended by the idea that the possibility of positive reinforcement might influence behavior.
- You wouldn’t work hard in a course or a job if your performance didn’t matter and all the grades or bonuses were given with no regard to quality.
- Operant conditioning provides one enormously useful and powerful way to change and improve behavior.