Chapter 1 - History of Cognitive Psychology

Definition of Cognitive Psychology

Imagine all of your thoughts as if they were physical entities, swirling rapidly inside your mind. How is it possible that the brain is able to move from one thought to the next in an organized, orderly fashion? The brain is endlessly perceiving, processing, planning, organizing, and remembering—it is always active. Yet, you don't notice most of your brain's activity as you move throughout your daily routine. This is only one facet of the complex processes involved in cognition. Simply put, cognition is thinking, and it encompasses the processes associated with perception, knowledge, problem solving, judgment, language, and memory. Scientists who study cognition are searching for ways to understand how we integrate, organize, and utilize our conscious cognitive experiences without being aware of all of the unconscious work that our brains are doing (for example, Kahneman, 2011).

Cognition

Upon waking each morning, you begin thinking—contemplating the tasks that you must complete that day. In what order should you run your errands? Should you go to the bank, the cleaners, or the grocery store first? Can you get these things done before you head to class or will they need to wait until school is done? These thoughts are one example of cognition at work. Exceptionally complex, cognition is an essential feature of human consciousness, yet not all aspects of cognition are consciously experienced.

Cognitive psychology is the field of psychology dedicated to examining how people think. It attempts to explain how and why we think the way we do by studying the interactions among human thinking, emotion, creativity, language, and problem solving, in addition to other cognitive processes. Cognitive psychologists strive to determine and measure different types of intelligence, why some people are better at problem solving than others, and how emotional intelligence affects success in the workplace, among countless other topics. They also sometimes focus on how we organize thoughts and information gathered from our environments into meaningful categories of thought, which will be discussed later.

Historical Roots: History of Cognition

"Cognition" is a term for a wide swath of mental functions that relate to knowledge and information processing.

LEARNING OBJECTIVES

- **Name major figures in the history of cognition.**

KEY TAKEAWAYS

Key Points

- **Cognition is the set of all mental abilities and processes related to knowledge, including attention, memory, judgment, reasoning, problem solving, decision making, and a host of other vital processes.**
- **Aristotle, Descartes, and Wundt are among the earliest philosophers who dealt specifically with the act of cognition.**
- **Cognitive processes can be analyzed through the lenses of many different fields, including linguistics, anesthesia, neuroscience, education, philosophy, biology, computer science, and psychology.**

Key Terms

- **cognition: The set of all mental abilities and processes related to knowledge.**
- **cognitive science: An interdisciplinary field that analyses mental functions and processes.**

Cogito Ergo Sum

Maybe you've heard the phrase *I think , therefore I am*, or perhaps even the Latin version: *Cogito ergo sum*. This simple expression is one of enormous philosophical importance, because it is about the act of thinking. Thought has been of fascination to humans for many centuries, with questions like *What is thinking?* and *How do people think?* and *Why do people think?* troubling and intriguing many philosophers, psychologists, scientists, and others.

The word "cognition" is the closest scientific synonym for thinking. It comes from the same root as the Latin word *cogito*, which is one of the forms of the verb "to know." Cognition is the set of all mental abilities and processes related to knowledge, including attention, memory, judgment, reasoning, problem solving, decision making, and a host of other vital processes.

Human cognition takes place at both conscious and unconscious levels. It can be concrete or abstract. It is intuitive, meaning that nobody has to learn or be taught how to think. It just happens as part of being human. Cognitive processes use existing knowledge but are capable of generating new knowledge through logic and inference.

History of Cognition

People have been studying knowledge in various ways for centuries. Some of the most important figures in the study of cognition are:

Aristotle (384–322 BCE)

The study of human cognition began over two thousand years ago. The Greek philosopher Aristotle was interested in many fields, including the inner workings of the mind and how they affect the human experience. He also placed great importance on ensuring that his studies and ideas were based on empirical evidence (scientific information that is gathered through

observation and careful experimentation).

Descartes (1596–1650)

René Descartes was a seventeenth-century philosopher who coined the famous phrase *I think, therefore I am* (albeit in French). The simple meaning of this phrase is that the act of thinking proves that a thinker exists. Descartes came up with this idea when trying to prove whether anyone could truly know anything despite the fact that our senses sometimes deceive us. As he explains, "We cannot doubt of our existence while we doubt."

Wilhelm Wundt (1832–1920)

Wilhelm Wundt is considered one of the founding figures of modern psychology; in fact, he was the first person to call himself a psychologist. Wundt believed that scientific psychology should focus on introspection, or analysis of the contents of one's own mind and experience. Though today Wundt's methods are recognized as being subjective and unreliable, he is one of the important figures in the study of cognition because of his examination of human thought processes.

Cognition, Psychology, and Cognitive Science

The term "cognition" covers a wide swath of processes, everything from memory to attention. These processes can be analyzed through the lenses of many different fields: linguistics, anesthesia, neuroscience, education, philosophy, biology, computer science, and of course, psychology, to name a few. Because of the number of disciplines that study cognition to some degree, the term can have different meanings in different contexts. For example, in psychology, "cognition" usually refers to processing of neural information; in social psychology the term "social cognition" refers to attitudes and group attributes. These numerous approaches to the analysis of cognition are synthesized in the relatively new field of cognitive science, the interdisciplinary study of mental processes and functions.

Mnemonic Devices

What is the nature of thought/how is it organized?

Concepts and Prototypes

The human nervous system is capable of handling endless streams of information. The senses serve as the interface between the mind and the external environment, receiving stimuli and translating it into nervous impulses that are transmitted to the brain. The brain then processes this information and uses the relevant pieces to create thoughts, which can then be expressed through language or stored in memory for future use. To make this process more complex, the brain does not gather information from external environments only. When thoughts are formed, the brain also pulls information from emotions and memories. Emotion and memory are powerful influences on both our thoughts and behaviors.

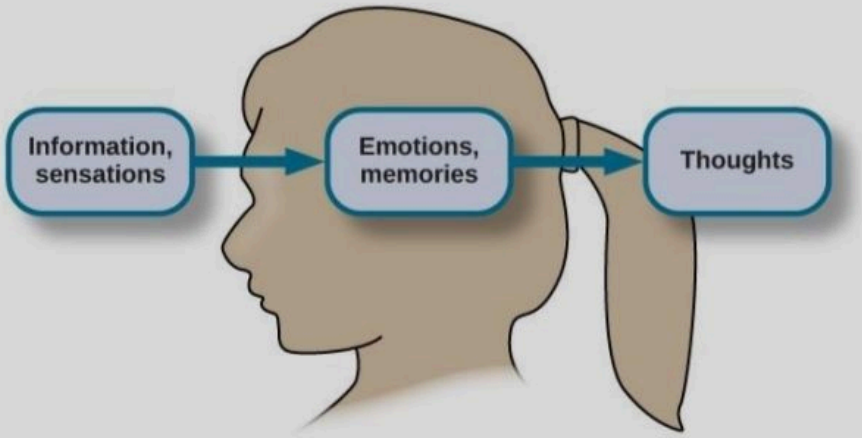


Figure 1. Sensations and information are received by our brains, filtered through emotions and memories, and processed to become thoughts.

In order to organize this staggering amount of information, the brain has developed a file cabinet of sorts in the mind. The different files stored in the file cabinet are called concepts. Concepts are categories or groupings of linguistic information, images, ideas, or memories, such as life experiences. Concepts are, in many ways, big ideas that are generated by observing details, and categorizing and combining these details into cognitive structures. You use concepts to see the relationships among the different elements of your experiences and to keep the information in your mind organized and accessible.

Concepts are informed by our semantic memory (you learned about this concept when you studied memory) and are present in every aspect of our lives; however, one of the easiest places to notice concepts is inside a classroom, where they are discussed explicitly. When you study United States history, for example, you learn about more than just individual events that have happened in America's past. You absorb a large quantity of information by listening to and participating in discussions, examining maps, and reading first-hand accounts of people's lives. Your brain analyzes these details and develops an overall understanding of American history. In the process, your brain gathers details that inform and refine your understanding of related concepts like democracy, power, and freedom.

Concepts can be complex and abstract, like justice, or more concrete, like types of birds. In psychology, for example, Piaget's stages of development are abstract concepts. Some concepts, like tolerance, are agreed upon by many people, because they have been used in various ways over many years. Other concepts, like the characteristics of your ideal friend or your family's birthday traditions, are personal and individualized. In this way, concepts touch every aspect of our lives, from our many daily routines to the guiding principles behind the way governments function.

Another technique used by your brain to organize information is the identification of prototypes for the concepts you have developed. A prototype is the best example or representation of a concept. For example, for the category of civil disobedience, your prototype

could be Rosa Parks. Her peaceful resistance to segregation on a city bus in Montgomery, Alabama, is a recognizable example of civil disobedience. Or your prototype could be Mohandas Gandhi, sometimes called Mahatma Gandhi ("Mahatma" is an honorific title).

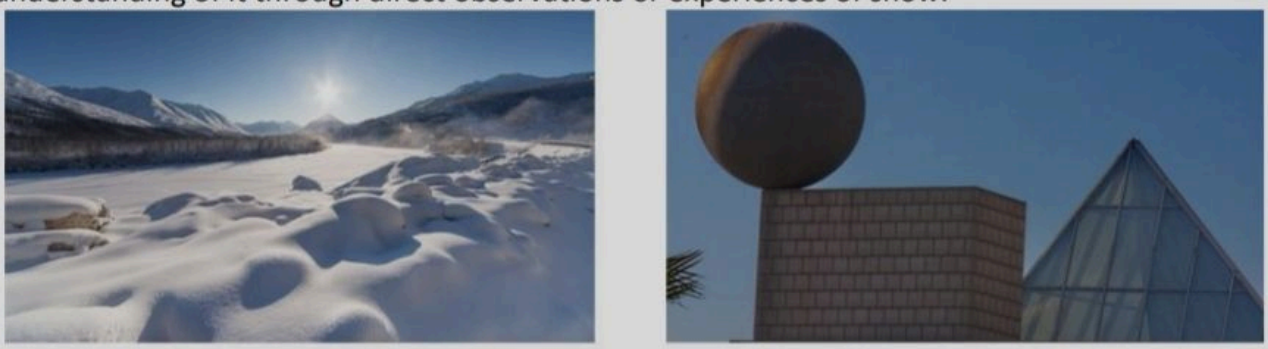
Figure 2. In 1930, Mohandas Gandhi led a group in peaceful protest against a British tax on salt in India.

Mohandas Gandhi served as a nonviolent force for independence for India while simultaneously demanding that Buddhist, Hindu, Muslim, and Christian leaders—both Indian and British—collaborate peacefully. Although he was not always successful in preventing violence around him, his life provides a steadfast example of the civil disobedience prototype (Constitutional Rights Foundation, 2013). Just as concepts can be abstract or concrete, we can make a distinction between concepts that are functions of our direct experience with the world and those that are more artificial in nature.

Natural and Artificial Concepts

In psychology, concepts can be divided into two categories, natural and artificial. Natural concepts are created "naturally" through your experiences and can be developed from either direct or indirect experiences. For example, if you live in Essex Junction, Vermont, you have probably had a lot of direct experience with snow. You've watched it fall from the sky, you've seen lightly falling snow that barely covers the windshield of your car, and you've shoveled out 18 inches of fluffy white snow as you've thought, "This is perfect for skiing." You've thrown snowballs at your best friend and gone sledding down the steepest hill in town. In short, you know snow. You know what it looks like, smells like, tastes like, and feels like. If, however, you've lived your whole life on the island of Saint Vincent in the Caribbean, you may never have actually seen snow, much less tasted, smelled, or touched it. You know snow from the indirect experience of seeing pictures of falling snow—or from watching films that feature snow as part

of the setting. Either way, snow is a natural concept because you can construct an understanding of it through direct observations or experiences of snow.



(a) (b)

Figure 3. (a) Our concept of snow is an example of a natural concept—one that we understand through direct observation and experience. (b) In contrast, artificial concepts are ones that we know by a specific set of characteristics that they always exhibit, such as what defines different basic shapes. (credit a: modification of work by Maarten Takens; credit b: modification of work by "Shayan (USA)"/Flickr)

An artificial concept, on the other hand, is a concept that is defined by a specific set of characteristics. Various properties of geometric shapes, like squares and triangles, serve as useful examples of artificial concepts. A triangle always has three angles and three sides. A square always has four equal sides and four right angles. Mathematical formulas, like the equation for area (length × width) are artificial concepts defined by specific sets of characteristics that are always the same. Artificial concepts can enhance the understanding of a topic by building on one another. For example, before learning the concept of "area of a square" (and the formula to find it), you must understand what a square is. Once the concept of "area of a square" is understood, an understanding of area for other geometric shapes can be built upon the original understanding of area. The use of artificial concepts to define an idea is crucial to communicating with others and engaging in complex thought. According to Goldstone and Kersten (2003), concepts act as building blocks and can be connected in countless combinations to create complex thoughts.

Schemata

A schema is a mental construct consisting of a cluster or collection of related concepts (Bartlett, 1932). There are many different types of schemata, and they all have one thing in common: schemata are a method of organizing information that allows the brain to work more efficiently. When a schema is activated, the brain makes immediate assumptions about the person or object being observed.

There are several types of schemata. A role schema makes assumptions about how individuals in certain roles will behave (Callero, 1994). For example, imagine you meet someone who introduces himself as a firefighter. When this happens, your brain automatically activates the "firefighter schema" and begins making assumptions that this person is brave, selfless, and community-oriented. Despite not knowing this person, already you have unknowingly made judgments about him. Schemata also help you fill in gaps in the information you receive from

the world around you. While schemata allow for more efficient information processing, there can be problems with schemata, regardless of whether they are accurate: Perhaps this particular firefighter is not brave, he just works as a firefighter to pay the bills while studying to become a children's librarian.

An event schema, also known as a cognitive script, is a set of behaviors that can feel like a routine. Think about what you do when you walk into an elevator. First, the doors open and you wait to let exiting passengers leave the elevator car. Then, you step into the elevator and turn around to face the doors, looking for the correct button to push. You never face the back of the elevator, do you? And when you're riding in a crowded elevator and you can't face the front, it feels uncomfortable, doesn't it? Interestingly, event schemata can vary widely among different cultures and countries. For example, while it is quite common for people to greet one another with a handshake in the United States, in Tibet, you greet someone by sticking your tongue out at them, and in Belize, you bump fists (Cairns Regional Council, n.d.)

Figure 4. What event schema do you perform when riding in an elevator? (credit: "Gideon"/Flickr)

Because event schemata are automatic, they can be difficult to change. Imagine that you are driving home from work or school. This event schema involves getting in the car, shutting the door, and buckling your seatbelt before putting the key in the ignition. You might perform this script two or three times each day. As you drive home, you hear your phone's ring tone. Typically, the event schema that occurs when you hear your phone ringing involves locating the phone and answering it or responding to your latest text message. So without thinking, you reach for your phone, which could be in your pocket, in your bag, or on the passenger seat of the car. This powerful event schema is informed by your pattern of behavior and the pleasurable stimulation that a phone call or text message gives your brain. Because it is a schema, it is extremely challenging for us to stop reaching for the phone, even though we know that we endanger our own lives and the lives of others while we do it (Neyfakh, 2013).

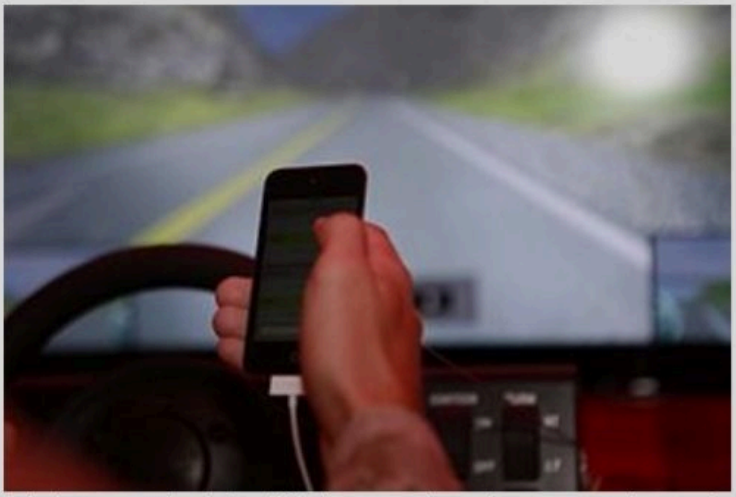


Figure 5.Texting while driving is dangerous, but it is a difficult event schema for some people to resist.

Remember the elevator? It feels almost impossible to walk in and *not* face the door. Our powerful event schema dictates our behavior in the elevator, and it is no different with our phones. Current research suggests that it is the habit, or event schema, of checking our phones in many different situations that makes refraining from checking them while driving especially difficult (Bayer & Campbell, 2012). Because texting and driving has become a dangerous epidemic in recent years, psychologists are looking at ways to help people interrupt the "phone schema" while driving. Event schemata like these are the reason why many habits are difficult to break once they have been acquired. As we continue to examine thinking, keep in mind how powerful the forces of concepts and schemata are to our understanding of the world.

Summary

In this section, you were introduced to cognitive psychology, which is the study of cognition, or the brain's ability to think, perceive, plan, analyze, and remember. Concepts and their corresponding prototypes help us quickly organize our thinking by creating categories into which we can sort new information. We also develop schemata, which are clusters of related concepts. Some schemata involve routines of thought and behavior, and these help us function properly in various situations without having to "think twice" about them. Schemata show up in social situations and routines of daily behavior.

Self Check Questions

Critical Thinking Questions

1. Describe a social schema that you would notice at a sporting event.
2. Explain why event schemata have so much power over human behavior.

Personal Application Question

3. Describe a natural concept that you know fully but that would be difficult for someone else to understand and explain why it would be difficult.

Answers

1. Answers will vary. When attending a basketball game, it is typical to support your team by wearing the team colors and sitting behind their bench.
2. Event schemata are rooted in the social fabric of our communities. We expect people to behave in certain ways in certain types of situations, and we hold ourselves to the same social standards. It is uncomfortable to go against an event schema—it feels almost like we are breaking the rules.

Glossary

- **Artificial Concept:** concept that is defined by a very specific set of characteristics
- **Cognition:** thinking, including perception, learning, problem solving, judgment, and memory
- **Cognitive Psychology:** field of psychology dedicated to studying every aspect of how people think
- **Concept:** category or grouping of linguistic information, objects, ideas, or life experiences
- **Cognitive Script:** set of behaviors that are performed the same way each time; also referred to as an event schema
- **Event Schema:** set of behaviors that are performed the same way each time; also referred to as a cognitive script
- **Natural Concept:** mental groupings that are created "naturally" through your experiences
- **Prototype:** best representation of a concept
- **Role Schema:** set of expectations that define the behaviors of a person occupying a particular role
- **Schema:** (plural = schemata) mental construct consisting of a cluster or collection of related concepts

Early Psychology—Structuralism and Functionalism

LEARNING OBJECTIVES

- **Define structuralism and functionalism and the contributions of Wundt and James to the development of psychology**

Psychology is a relatively young science with its experimental roots in the 19th century, compared, for example, to human physiology, which dates much earlier. As mentioned, anyone interested in exploring issues related to the mind generally did so in a philosophical context prior to the 19th century. Two men, working in the 19th century, are generally credited as being the founders of psychology as a science and academic discipline that was distinct from

philosophy. Their names were Wilhelm Wundt and William James.

School of psychology	Description	Important contributors
Structuralism	Uses the method of introspection to identify the basic elements or "structures" of psychological experience	Wilhelm Wundt, Edward B. Titchener
Functionalism	Attempts to understand why animals and humans have developed the particular psychological aspects that they currently possess	William James
Psychodynamic	Focuses on the role of our unconscious thoughts, feelings, and memories and our early childhood experiences in determining behavior	Sigmund Freud, Carl Jung, Alfred Adler, Erik Erickson
Behaviorism	Based on the premise that it is not possible to objectively study the mind, and therefore that psychologists should limit their attention to the study of behavior itself	John B. Watson, B. F. Skinner
Cognitive	The study of mental processes, including perception, thinking, memory, and judgments	Hermann Ebbinghaus, Sir Frederic Bartlett, Jean Piaget
Social-cultural	The study of how the social situations and the cultures in which people find themselves influence thinking and behavior	Fritz Heider, Leon Festinger, Stanley Schachter

Table 1. The Most Important Approaches (Schools) of Psychology

Wundt and Structuralism

Wilhelm Wundt (1832–1920) was a German scientist who was the first person to be referred to as a psychologist. His famous book entitled *Principles of Physiological Psychology* was published in 1873. Wundt viewed psychology as a scientific study of conscious experience, and he believed that the goal of psychology was to identify components of consciousness and how those components combined to result in our conscious experience. Wundt used introspection (he called it "internal perception"), a process by which someone examines their own conscious experience as objectively as possible, making the human mind like any other aspect of nature that a scientist observed. Wundt's version of introspection used only very specific experimental conditions in which an external stimulus was designed to produce a scientifically observable (repeatable) experience of the mind (Danziger, 1980). The first stringent requirement was the use of "trained" or practiced observers, who could immediately observe and report a reaction. The second requirement was the use of repeatable stimuli that always produced the same

experience in the subject and allowed the subject to expect and thus be fully attentive to the inner reaction. These experimental requirements were put in place to eliminate "interpretation" in the reporting of internal experiences and to counter the argument that there is no way to know that an individual is observing their mind or consciousness accurately, since it cannot be seen by any other person. This attempt to understand the structure or characteristics of the mind was known as **structuralism**. Wundt established his psychology laboratory at the University at Leipzig in 1879. In this laboratory, Wundt and his students conducted experiments on, for example, reaction times. A subject, sometimes in a room isolated from the scientist, would receive a stimulus such as a light, image, or sound. The subject's reaction to the stimulus would be to push a button, and an apparatus would record the time to reaction. Wundt could measure reaction time to one-thousandth of a second (Nicolas & Ferrand, 1999).

(a) (b)

Figure 6. (a) Wilhelm Wundt is credited as one of the founders of psychology. He created the first laboratory for psychological research. (b) This photo shows him seated and surrounded by fellow researchers and equipment in his laboratory in Germany. However, despite his efforts to train individuals in the process of introspection, this process remained highly subjective, and there was very little agreement between individuals. As a result, structuralism fell out of favor with the passing of Wundt's student, Edward Titchener, in 1927 (Gordon, 1995).

Follow the link for a deeper look at Structuralism & Functionalism

James and Functionalism

William James (1842–1910) was the first American psychologist who espoused a different perspective on how psychology should operate. James was introduced to Darwin's theory of evolution by natural selection and accepted it as an explanation of an organism's characteristics. Key to that theory is the idea that natural selection leads to organisms that are adapted to their environment, including their behavior. Adaptation means that a trait of an organism has a function for the survival and reproduction of the individual, because it has been naturally selected. As James saw it, psychology's purpose was to study the function of behavior in the world, and as such, his perspective was known as **functionalism**. Functionalism focused on how mental activities helped an organism fit into its environment. Functionalism has a second, more subtle meaning in that functionalists were more interested in the operation of

the whole mind rather than of its individual parts, which were the focus of structuralism. Like Wundt, James believed that introspection could serve as one means by which someone might study mental activities, but James also relied on more objective measures, including the use of various recording devices, and examinations of concrete products of mental activities and of anatomy and physiology (Gordon, 1995).

Figure 7. William James, shown here in a self-portrait, was the first American psychologist.

GLOSSARY

- **Functionalism:** focused on how mental activities helped an organism adapt to its environment
- **Structuralism:** understanding the conscious experience through introspection

Behaviorism

How do we act?

Learning theories focus on how we respond to events or stimuli rather than emphasizing what motivates our actions. These theories provide an explanation of how experience can change what we are capable of doing or feeling.

Classical Conditioning and Emotional Responses

Classical Conditioning theory helps us to understand how our responses to one situation become attached to new situations. For example, a smell might remind us of a time when we

were a kid (elementary school cafeterias smell like milk and mildew!). If you went to a new cafeteria with the same smell, it might evoke feelings you had when you were in school. Or a song on the radio might remind you of a memorable evening you spent with your first true love. Or, if you hear your entire name (John Wilmington Brewer, for instance) called as you walk across the stage to get your diploma and it makes you tense because it reminds you of how your father used to use your full name when he was mad at you, you've been classically conditioned!

Classical conditioning explains how we develop many of our emotional responses to people or events or our "gut level" reactions to situations. New situations may bring about an old response because the two have become connected. Attachments form in this way. Addictions are affected by classical conditioning, as anyone who's tried to quit smoking can tell you. When you try to quit, everything that was associated with smoking makes you crave a cigarette.

Pavlov

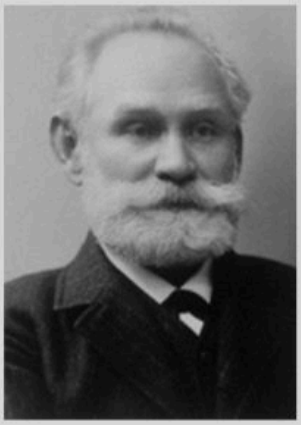


Figure 8. Ivan Pavlov

Ivan Pavlov (1880-1937) was a Russian physiologist interested in studying digestion. As he recorded the amount of salivation his laboratory dogs produced as they ate, he noticed that they actually began to salivate before the food arrived as the researcher walked down the hall and toward the cage. "This," he thought, "is not natural!" One would expect a dog to automatically salivate when food hit their palate, but BEFORE the food comes? Of course, what had happened was . . . you tell me. That's right! The dogs knew that the food was coming because they had learned to associate the footsteps with the food. The key word here is "learned". A learned response is called a "conditioned" response. Pavlov began to experiment with this "psychic" reflex. He began to ring a bell, for instance, prior to introducing the food. Sure enough, after making this connection several times, the dogs could be made to salivate to the sound of a bell. Once the bell had become an event to which the dogs had learned to salivate, it was called a conditioned stimulus. The act of salivating to a bell was a response that had also been learned, now termed in Pavlov's jargon, a conditioned response. Notice that the response, salivation, is the same whether it is conditioned or unconditioned (unlearned or natural). What changed is the stimulus to which the dog salivates. One is natural (unconditioned) and one is learned (conditioned). Well, enough of Pavlov's dogs. Who cares?

Let's think about how classical conditioning is used on us. One of the most widespread applications of classical conditioning principles was brought to us by the psychologist, John B. Watson.

Watson and Behaviorism

Watson believed that most of our fears and other emotional responses are classically conditioned. He had gained a good deal of popularity in the 1920s with his expert advice on parenting offered to the public. He believed that parents could be taught to help shape their children's behavior and tried to demonstrate the power of classical conditioning with his famous experiment with an 18 month old boy named "Little Albert". Watson sat Albert down and introduced a variety of seemingly scary objects to him: a burning piece of newspaper, a white rat, etc. But Albert remained curious and reached for all of these things. Watson knew that one of our only inborn fears is the fear of loud noises so he proceeded to make a loud noise each time he introduced one of Albert's favorites, a white rat. After hearing the loud noise several times paired with the rat, Albert soon came to fear the rat and began to cry when it was introduced. Watson filmed this experiment for posterity and used it to demonstrate that he could help parents achieve any outcomes they desired, if they would only follow his advice. Watson wrote columns in newspapers and in magazines and gained a lot of popularity among parents eager to apply science to household order. Parenting advice was not the legacy Watson left us, however. Where he really made his impact was in advertising. After Watson left academia, he went into the world of business and showed companies how to tie something that brings about a natural positive feeling to their products to enhance sales. Thus the union of sex and advertising! So, let's use a much more interesting example than Pavlov's dogs to check and see if you understand the difference between conditioned and unconditioned stimuli and responses. In the experiment with Little Albert, identify the unconditioned stimulus, the unconditioned response, and, after conditioning, the conditioned stimulus and the conditioned response.

Operant Conditioning and Repeating Actions

Operant Conditioning is another learning theory that emphasizes a more conscious type of learning than that of classical conditioning. A person (or animal) does something (operates something) to see what effect it might bring. Simply said, operant conditioning describes how we repeat behaviors because they pay off for us. It is based on a principle authored by a psychologist named Thorndike (1874-1949) called the law of effect. The law of effect suggest that we will repeat an action if it is followed by a good effect.

Skinner and Reinforcement

Watch a pigeon learn through the concept reinforcement:

B.F. Skinner (1904-199 expanded on Thorndike's principle and outlined the principles of operant conditioning. Skinner believed that we learn best when our actions are reinforced. For example, a child who cleans his room and is reinforced (rewarded) with a big hug and words of praise is more likely to clean it again than a child whose deed goes unnoticed. Skinner believed that almost anything could be reinforcing. A reinforcer is anything following a behavior that makes it more likely to occur again. It can be something intrinsically rewarding (called intrinsic or primary reinforcers), such as food or praise, or it can be rewarding because it can be exchanged for what one really wants (such as using money to buy a cookie). Such reinforcers are referred to as secondary reinforcers or extrinsic reinforcers.

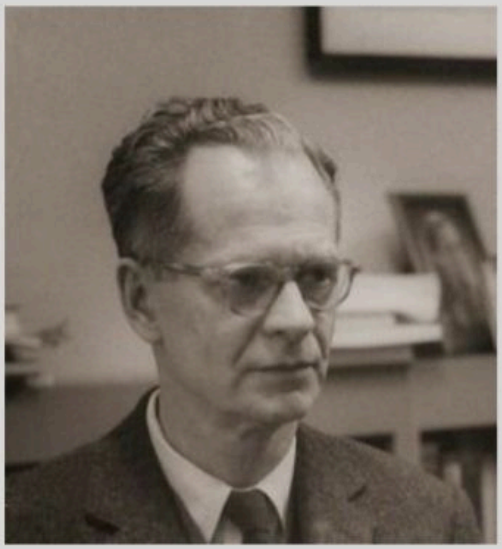


Figure 9. B. F. Skinner (1950)

Positive and negative reinforcement

Sometimes, adding something to the situation is reinforcing as in the cases we described above with cookies, praise and money. Positive reinforcement involves adding something to the situation to encourage a behavior. Other times, taking something away from a situation can be reinforcing. For example, the loud, annoying buzzer on your alarm clock encourages you to get up so that you can turn it off and get rid of the noise. Children whine in order to get their parents to do something and often, parents give in just to stop the whining. In these instances, negative reinforcement has been used.

Operant conditioning tends to work best if you focus on trying to encourage a behavior or move a person into the direction you want them to go rather than telling them what not to do. Reinforcers are used to encourage a behavior; punishers are used to stop behavior. A punisher is anything that follows an act and decreases the chance it will reoccur. But often a punished behavior doesn't really go away. It is just suppressed and may reoccur whenever the threat of punishment is removed. For example, a child may not cuss around you because you've washed his mouth out with soap, but he may cuss around his friends. Or a motorist may only slow down when the trooper is on the side of the freeway. Another problem with punishment is that when a person focuses on punishment, they may find it hard to see what the other does right or

well. And punishment is stigmatizing; when punished, some start to see themselves as bad and give up trying to change.

Reinforcement can occur in a predictable way, such as after every desired action is performed, or intermittently, after the behavior is performed a number of times or the first time it is performed after a certain amount of time. The schedule of reinforcement has an impact on how long a behavior continues after reinforcement is discontinued. So a parent who has rewarded a child's actions each time may find that the child gives up very quickly if a reward is not immediately forthcoming. A lover who is warmly regarded now and then may continue to seek out his or her partner's attention long after the partner has tried to break up. Think about the kinds of behaviors you may have learned through classical and operant conditioning. You may have learned many things in this way. But sometimes we learn very complex behaviors quickly and without direct reinforcement. Bandura explains how.

Gestalt Psychology

LEARNING OBJECTIVES

By the end of this section, you will be able to:

- **Explain the figure-ground relationship**
- **Define Gestalt principles of grouping**
- **Describe how perceptual set is influenced by an individual's characteristics and mental state**

In the early part of the 20th century, Max Wertheimer published a paper demonstrating that individuals perceived motion in rapidly flickering static images—an insight that came to him as he used a child's toy tachistoscope. Wertheimer, and his assistants Wolfgang Köhler and Kurt Koffka, who later became his partners, believed that perception involved more than simply combining sensory stimuli. This belief led to a new movement within the field of psychology known as Gestalt psychology. The word *gestalt* literally means form or pattern, but its use reflects the idea that the whole is different from the sum of its parts. In other words, the brain creates a perception that is more than simply the sum of available sensory inputs, and it does so in predictable ways. Gestalt psychologists translated these predictable ways into principles by which we organize sensory information. As a result, Gestalt psychology has been extremely influential in the area of sensation and perception (Rock & Palmer, 1990).

One Gestalt principle is the figure-ground relationship. According to this principle, we tend to segment our visual world into figure and ground. Figure is the object or person that is the focus of the visual field, while the ground is the background. As [link] shows, our perception can vary tremendously, depending on what is perceived as figure and what is perceived as ground. Presumably, our ability to interpret sensory information depends on what we label as figure and what we label as ground in any particular case, although this assumption has been called

into question (Peterson & Gibson, 1994; Vecera & O'Reilly, 1998).

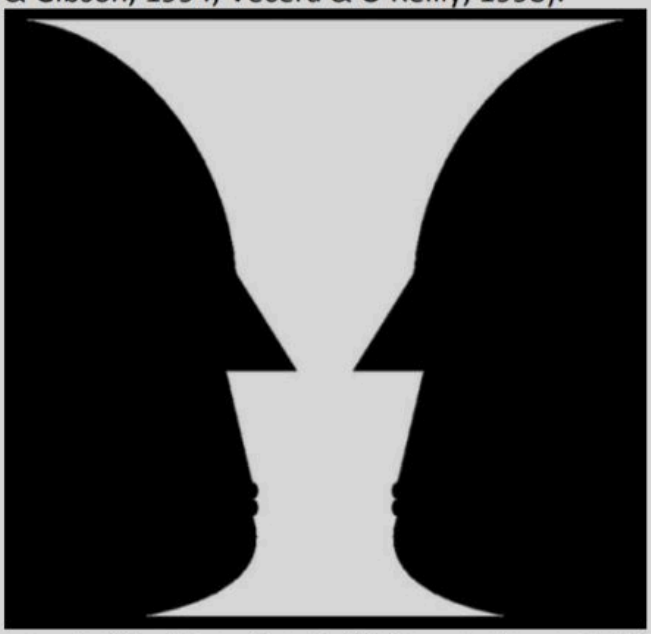


Figure 10. The concept of figure-ground relationship explains why this image can be perceived either as a vase or as a pair of faces.

Another Gestalt principle for organizing sensory stimuli into meaningful perception is proximity. This principle asserts that things that are close to one another tend to be grouped together, as is illustrated in the image below.

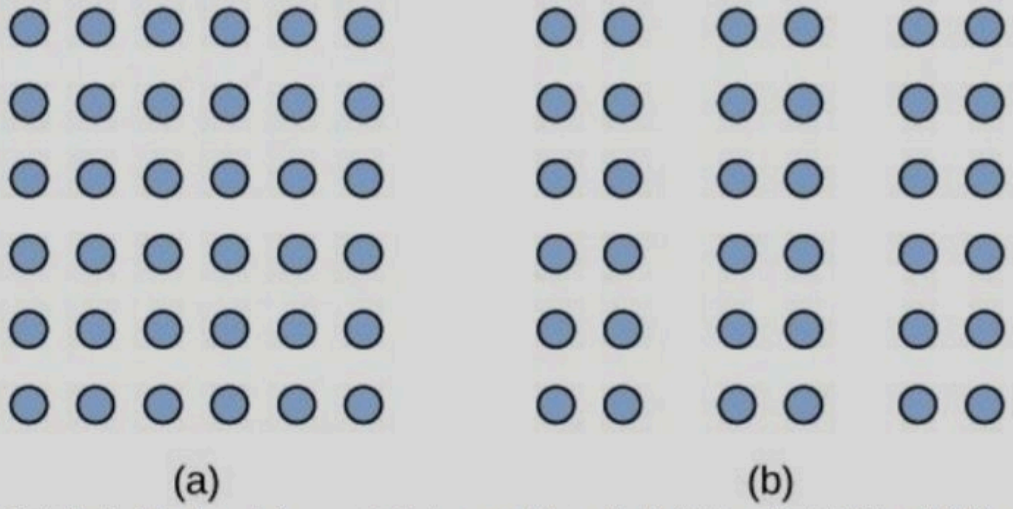


Figure 11. The Gestalt principle of proximity suggests that you see (a) one block of dots on the left side and (b) three columns on the right side.

How we read something provides another illustration of the proximity concept. For example, we read this sentence like this, notl iket hiso rt hat. We group the letters of a given word together because there are no spaces between the letters, and we perceive words because there are spaces between each word. Here are some more examples: Cany oum akes enseo ft hiss entence? What doth es e wor dsmea n?

We might also use the principle of similarity to group things in our visual fields. According to

this principle, things that are alike tend to be grouped together. For example, when watching a football game, we tend to group individuals based on the colors of their uniforms. When watching an offensive drive, we can get a sense of the two teams simply by grouping along this dimension.

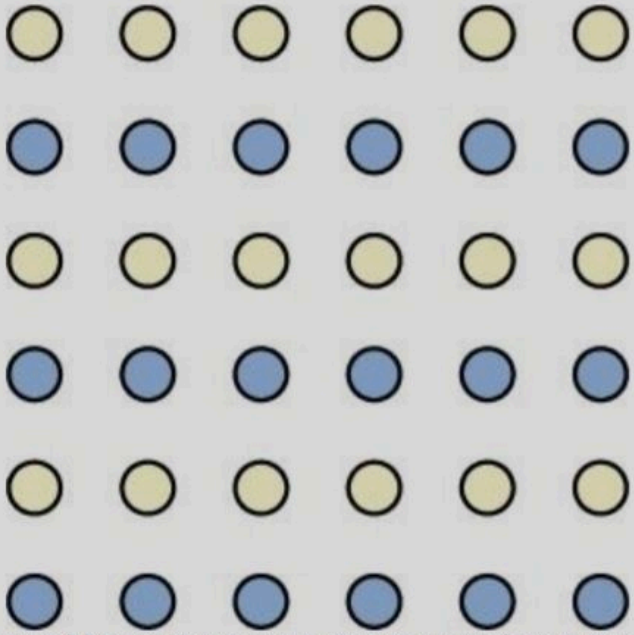


Figure 12. When looking at this array of dots, we likely perceive alternating rows of colors. We are grouping these dots according to the principle of similarity.

Two additional Gestalt principles are the law of continuity (or good continuation) and closure. The law of continuity suggests that we are more likely to perceive continuous, smooth flowing lines rather than jagged, broken lines. The principle of closure states that we organize our perceptions into complete objects rather than as a series of parts.

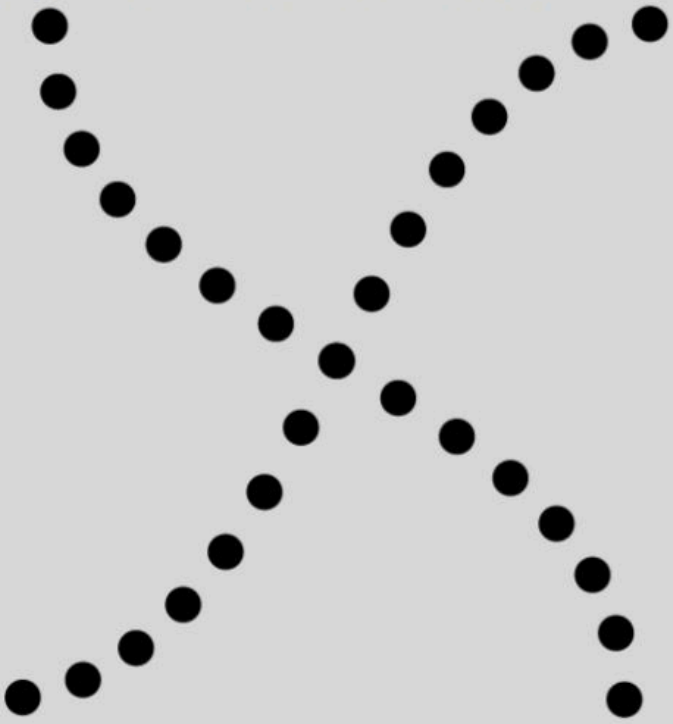


Figure 13. Good continuation would suggest that we are more likely to perceive this as two overlapping lines, rather than four lines meeting in the center.

Figure 14. Closure suggests that we will perceive a complete circle and rectangle rather than a series of segments.

Link to Learning

Watch this video showing real world illustrations of Gestalt principles.

According to Gestalt theorists, pattern perception, or our ability to discriminate among different figures and shapes, occurs by following the principles described above. You probably feel fairly certain that your perception accurately matches the real world, but this is not always the case. Our perceptions are based on perceptual hypotheses: educated guesses that we make while interpreting sensory information. These hypotheses are informed by a number of factors, including our personalities, experiences, and expectations. We use these hypotheses to generate our perceptual set. For instance, research has demonstrated that those who are given verbal priming produce a biased interpretation of complex ambiguous figures (Goolkasian & Woodbury, 2010).

Dig Deeper: The Depths of Perception: Bias, Prejudice, and Cultural Factors

In this chapter, you have learned that perception is a complex process. Built from sensations, but influenced by our own experiences, biases, prejudices, and cultures, perceptions can be very different from person to person. Research suggests that implicit racial prejudice and stereotypes affect perception. For instance, several studies have demonstrated that non-Black participants identify weapons faster and are more likely to identify non-weapons as weapons when the image of the weapon is paired with the image of a Black person (Payne, 2001; Payne, Shimizu, & Jacoby, 2005). Furthermore, White individuals' decisions to shoot an armed target in a video game is made more quickly when the target is Black (Correll, Park, Judd, & Wittenbrink, 2002; Correll, Urland, & Ito, 2006). This research is important, considering the number of very high-profile cases in the last few decades in which young Blacks were killed by people who claimed to believe that the unarmed individuals were armed and/or represented some threat to their personal safety.

Summary

Gestalt theorists have been incredibly influential in the areas of sensation and perception. Gestalt principles such as figure-ground relationship, grouping by proximity or similarity, the law of good continuation, and closure are all used to help explain how we organize sensory information. Our perceptions are not infallible, and they can be influenced by bias, prejudice, and other factors.

SELF CHECK QUESTIONS

Critical Thinking Question

1. The central tenet of Gestalt psychology is that the whole is different from the sum of its parts. What does this mean in the context of perception?
2. Take a look at the following figure. How might you influence whether people see a duck or a rabbit?

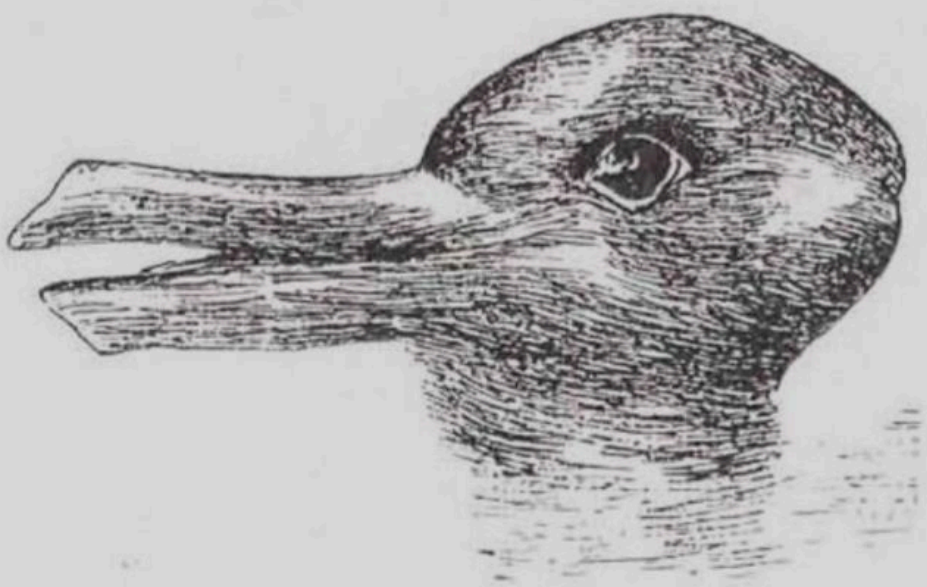


Figure 15.

Personal Application Question

3. Have you ever listened to a song on the radio and sung along only to find out later that you have been singing the wrong lyrics? Once you found the correct lyrics, did your perception of the song change?

ANSWERS

1. This means that perception cannot be understood completely simply by combining the parts. Rather, the relationship that exists among those parts (which would be established according to the principles described in this chapter) is important in organizing and interpreting sensory information into a perceptual set.
2. Playing on their expectations could be used to influence what they were most likely to see. For instance, telling a story about Peter Rabbit and then presenting this image would bias perception along rabbit lines.

GLOSSARY

- **Closure:** organizing our perceptions into complete objects rather than as a series of parts
- **Figure-ground Relationship:** segmenting our visual world into figure and ground
- **Gestalt Psychology:** field of psychology based on the idea that the whole is different from the sum of its parts
- **Good Continuation:** (also, continuity) we are more likely to perceive continuous, smooth flowing lines rather than jagged, broken lines
- **Pattern Perception:** ability to discriminate among different figures and shapes
- **Perceptual Hypothesis:** educated guess used to interpret sensory information
- **Principle of Closure:** organize perceptions into complete objects rather than as a series of parts
- **Proximity:** things that are close to one another tend to be grouped together
- **Similarity:** things that are alike tend to be grouped together

Contributions to Cognitive Psychology "Birth"

Behaviorism's emphasis on objectivity and focus on external behavior had pulled psychologists' attention away from the mind for a prolonged period of time. The early work of the humanistic psychologists redirected attention to the individual human as a whole, and as a conscious and self-aware being. By the 1950s, new disciplinary perspectives in linguistics, neuroscience, and computer science were emerging, and these areas revived interest in the mind as a focus of scientific inquiry. This particular perspective has come to be known as the cognitive revolution (Miller, 2003). By 1967, Ulric Neisser published the first textbook entitled *Cognitive Psychology*, which served as a core text in cognitive psychology courses around the country (Thorne & Henley, 2005).

Although no one person is entirely responsible for starting the cognitive revolution, Noam Chomsky was very influential in the early days of this movement. Chomsky (1928–), an American linguist, was dissatisfied with the influence that behaviorism had had on psychology. He believed that psychology's focus on behavior was short-sighted and that the field had to re-incorporate mental functioning into its purview if it were to offer any meaningful contributions to understanding behavior (Miller, 2003).

Figure 16. Noam Chomsky was very influential in beginning the cognitive revolution. In 2010, this mural honoring him was put up in Philadelphia, Pennsylvania. (credit: Robert Moran)

European psychology had never really been as influenced by behaviorism as had American psychology; and thus, the cognitive revolution helped reestablish lines of communication between European psychologists and their American counterparts. Furthermore, psychologists began to cooperate with scientists in other fields, like anthropology, linguistics, computer science, and neuroscience, among others. This interdisciplinary approach often was referred to as the cognitive sciences, and the influence and prominence of this particular perspective resonates in modern-day psychology (Miller, 2003).

Noam Chomsky

In the middle of the 20th century, American linguist Noam Chomsky explained how some aspects of language could be innate. Prior to this time, people tended to believe that children learn language soley by imitating the adults around them. Chomsky agreed that individual words must be learned by experience, but he argued that genes could code into the brain categories and organization that form the basis of grammatical structure. We come into the world ready to distinguish different grammatical classes, like nouns and verbs and adjectives, and sensitive to the order in which words are spoken. Then, using this innate sensitivity, we quickly learn from listening to our parents about how to organize our own language [5][6] For instance, if we grow up hearing Spanish, we learn that adjectives come after nouns (*el gato amarillo*, where *gato* means "cat" and *amarillo* is "yellow"), but if we grow up hearing English, we learn that adjectives come first ("the yellow cat"). Chomsky termed this *innate sensitivity that allows infants and young children to organize the abstract categories of language* the ***language acquisition device (LAD)***.

According to Chomsky's approach, each of the many languages spoken around the world (there are between 6,000 and 8,000) is an individual example of the same underlying set of procedures that are hardwired into human brains. Each language, while unique, is just a set of variations on a small set of possible rule systems that the brain permits language to use.

Chomsky's account proposes that children are born with a knowledge of general rules of grammar (including phoneme, morpheme, and syntactical rules) that determine how sentences are constructed.

Although there is general agreement among psychologists that babies are genetically programmed to learn language, there is still debate about Chomsky's idea that a universal grammar can account for all language learning. Evans and Levinson [7] surveyed the world's languages and found that none of the presumed underlying features of the language acquisition device were entirely universal. In their search they found languages that did not have noun or verb phrases, that did not have tenses (e.g., past, present, future), and some that did not have nouns or verbs at all, even though a basic assumption of a universal grammar is that all languages should share these features. Other psychologists believe that early experience can fully explain language acquisition, and Chomsky's language acquisition device is unnecessary. Nevertheless, Chomsky's work clearly laid out the many problems that had to be solved in order to adequately explain how children acquire language and why languages have the structures that they do.

Connectionism – Parallel Distributive Processing

Connectionism was based on principles of associationism, mostly claiming that elements or ideas become associated with one another through experience and that complex ideas can be explained through a set of simple rules. But connectionism further expandedthese assumptions and introduced ideas like distributed representations and supervised learning and should not be confused with associationism.

Connectionism and Network Models

Network models of memory storage emphasize the role of connections between stored memories in the brain. The basis of these theories is that neural networks connect and interact to store memories by modifying the strength of the connections between neural units. In network theory, each connection is characterized by a weight value that indicates the strength of that particular connection. The stronger the connection, the easier a memory is to retrieve. Network models are based on the concept of connectionism. Connectionism is an approach in cognitive science that models mental or behavioral phenomena as the emergent processes of interconnected networks that consist of simple units. Connectionism was introduced in the 1940s by Donald Hebb, who said the famous phrase, "Cells that fire together wire together." This is the key to understanding network models: neural units that are activated together strengthen the connections between themselves.

There are several types of network models in memory research. Some define the fundamental network unit as a piece of information. Others define the unit as a neuron. However, network models generally agree that memory is stored in neural networks and is strengthened or weakened based on the connections between neurons. Network models are not the only models of memory storage, but they do have a great deal of power when it comes to explaining how learning and memory work in the brain, so they are extremely important to understand.

Parallel Distributed Processing Model

The parallel distributed processing (PDP) model is an example of a network model of memory, and it is the prevailing connectionist approach today. PDP posits that memory is made up of neural networks that interact to store information. It is more of a metaphor than an actual biological theory, but it is very useful for understanding how neurons fire and wire with each other.

Taking its metaphors from the field of computer science, this model stresses the parallel nature of neural processing. "Parallel processing" is a computing term; unlike serial processing (performing one operation at a time), parallel processing allows hundreds of operations to be completed at once—in parallel. Under PDP, neural networks are thought to work in parallel to change neural connections to store memories. This theory also states that memory is stored by modifying the strength of connections between neural units. Neurons that fire together frequently (which occurs when a particular behavior or mental process is engaged many times) have stronger connections between them. If these neurons stop interacting, the memory's strength weakens. This model emphasizes learning and other cognitive phenomena in the creation and storage of memory.

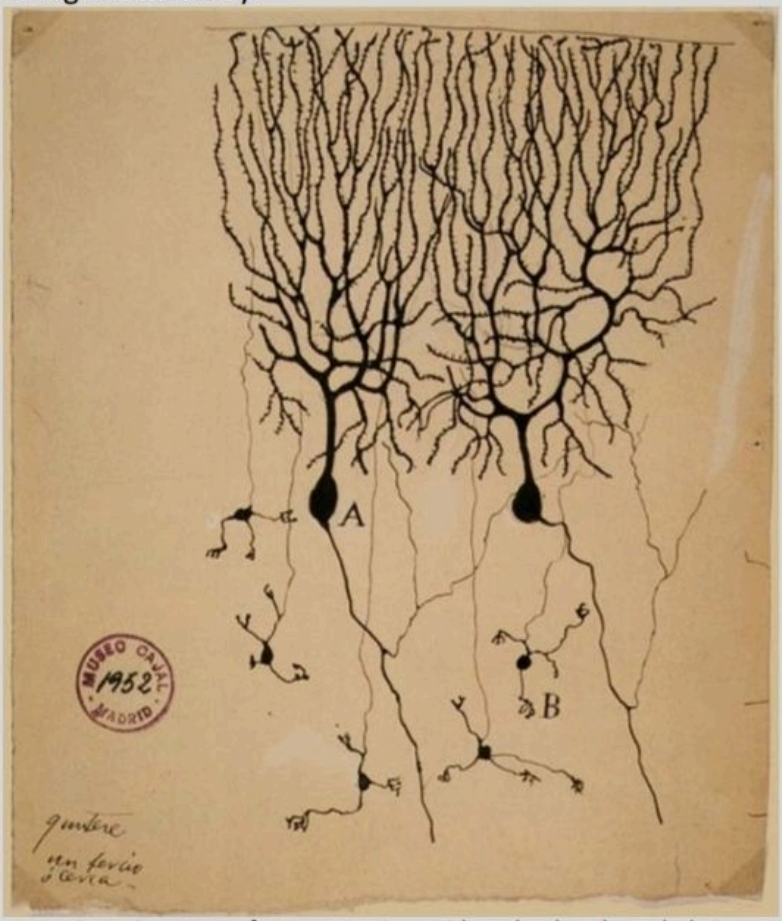


Figure 17. Neural connections: As neurons form connections with each other through their many dendrites, they can form complex networks. Network models propose that these connections are the basis of storing and retrieving memories.