Textbook:

- **Module 8.1 The Organization of Knowledge:**
- **Concepts and Categories:**
- A **concept** is a mental representation of an object, event, or idea.
- A **category** is a cluster of interrelated concepts. We form these groups using a process called **categorization**.
- **Classical Categories Definitions and Rules:**
- Categorization is difficult to define in that it involves elements of perception, memory, and "higher-order" processes like decision making and language.
- The earliest approach to the study of categories is referred to as **classical categorization**. This theory claims that objects or events are categorized according to a certain set of rules or by a specific set of features.
- Classical categorization does not tell the full story of how categorization works, however. We use a variety of cognitive processes in determining which objects fit which category. One of the major problems we confront in this process is **graded membership**, the observation that some concepts appear to make better category members than others.
- **Prototypes Categorization by Comparison:**
- **Prototypes** are mental representations of an average category member.
- Prototypes allow for classification by resemblance. When you encounter a little creature you have never seen before, its basic shape can be compared to your prototype of a bird. A match will then be made and you can classify the creature as a bird. Notice how different this process is from classical categorization: No rules or definitions are involved, just a set of similarities in overall shape and function.
- The main advantage of prototypes is that they help explain why some category members make better examples than others.
- We can use either categorization or prototypes to make a choice. The choice really depends on how complicated a category or a specific example might be. If there are a few major distinctions between items, we use prototypes; if there are complications, we switch to categorization.
- **Networks and Hierarchies:**
- A **semantic network** is an interconnected set of nodes or concepts and the links that join them to form a category.
- Semantic networks are usually arranged in a hierarchy and usually moves from general (top of the hierarchy) to very specific (bottom of hierarchy).
- This organization is important because different levels of the category are useful in different situations. The most frequently used level, in both thought and language, is the **basic-level category**. The basic-level category is the most frequently used level because:
    1. Basic-level categories are the terms used most often in conversation.
    2. They are the easiest to pronounce.
    3. They are the level at which prototypes exist.
    4. They are the level at which most thinking occurs.

- **Working the Scientific Literacy Model, Priming and Semantic Networks:**
- **Priming** is the activation of individual concepts in long-term memory.
  E.g. Hearing the word fruit might lead you to think of an apple, and the apple may lead you to think of a computer, which may lead you to think of a paper that is due tomorrow.
- Research has shown that priming can also occur without your awareness.
- Psychologists can test for priming through reaction time measurements, such as through a method called the **lexical decision task**. With the lexical decision method, a volunteer sits at a computer and stares at a focal point. Next, a string of letters flashes on the screen. The volunteer responds yes or no as quickly as possible to indicate whether the letters spell a word. Using this method, a volunteer should respond faster that “apple” is a word if it follows the word “fruit” (which is semantically related) than if it follows the word “bus” (which is not semantically related).
- **Memory, Culture, and Categories:**
- People integrate new stimuli into categories based on what they have experienced before. When we encounter a new item, we select its category by retrieving the item(s) that are most similar to it from memory.
- **Categories, Memory, and the Brain:**
- The fact that our ability to make categorical decisions is influenced by previous experiences tells us that this process involves memory.
- Some patients with damage to the temporal lobes have trouble identifying objects such as pictures of animals or vegetables despite the fact that they were able to describe the different shapes that made up those objects. The fact that these deficits were for particular categories of objects was intriguing, as it suggested that damaging certain parts of the brain could impair the ability to recognize some categories while leaving others unaffected. Because these problems were isolated to certain categories, these patients were diagnosed as having a disorder known as **category specific visual agnosia (CSVA)**.
  I.e. Several patients with CSVA had difficulties identifying fruits, vegetables, and/or animals but were still able to accurately identify members of categories such as tools and furniture.
- Researchers have noted that it would be physically impossible for our brains to have specialized regions for every category we have encountered because there isn’t enough space for this to occur. They proposed that evolutionary pressures led to the development of specialized circuits in the brain for a small group of categories that were important for our survival. These categories included animals, fruits and vegetables, members of our own species, and possibly tools. This theory is in agreement with brain-imaging studies showing that different parts of the temporal lobes are active when people view items from different categories including animals, tools, and people. Thus, although different people will vary in terms of the exact location that these categories are stored, it does appear that some categories are stored separately from others.

- **Categories and Culture:**
- The human brain is wired to perceive similarities and differences and to categorize items based on these comparisons as well as on our previous experiences with members of different categories. However, how we categorize objects depends to a great extent on what we have learned about those objects from others in our culture.
- Cultural differences in how people think and categorize items have led to the idea of **linguistic relativity/ Whorfian hypothesis**, the theory that the language we use determines how we understand and categorize the world.
- Research on linguistic relativity suggests that language can have some effects on categorization, but the effects are limited.
- **Module 8.2 Problem Solving, Judgment, and Decision Making:**
- **Defining and Solving Problems:**
- **Problem solving** means accomplishing a goal when the solution or the path to the solution is not clear.
- **Problem-Solving Strategies and Techniques:**
- There are two main strategies for problem solving. One strategy for problem solving is more objective, logical, and slower, whereas the other is more subjective, intuitive, and quicker.
- When we think logically, we rely on **algorithms**, problem-solving strategies based on a series of rules. As such, they are very logical and follow a set of steps, usually in a pre-set order. While computers are very good at using algorithms because they can follow a preprogrammed set of steps and perform thousands of operations every second, people are not always so rule-bound. We tend to rely on intuition to find strategies and solutions that seem like a good fit for the problem. These are called **heuristics**, problem-solving strategies that stem from prior experiences and provide an educated guess as to what is the most likely solution. Heuristics are often quite efficient, accurate and allow us to find solutions and to make decisions quickly.
- **Cognitive Obstacles:**
- While having a routine solution available for a problem generally allows us to solve that problem with less effort than we would use if we encountered it for the first time, sometimes, routines may impose cognitive barriers that impede solving a problem if the circumstances change so that the routine solution no longer works.
- A **mental set** is a cognitive obstacle that occurs when an individual attempts to apply a routine solution to what is actually a new type of problem.
- A type of mental set, **functional fixedness**, occurs when an individual identifies an object or technique that could potentially solve a problem, but can think of only its most obvious function.
- **Judgment and Decision Making:**
- Like problem solving, judgments and decisions can be based on logical algorithms, intuitive heuristics, or a combination of both.

- We tend to use heuristics more often than we realize, even those of us who consider ourselves to be logical thinkers.
- **Conjunction Fallacies and Representativeness:**
- The **conjunction fallacy** is the mistaken belief that finding a specific member in two overlapping categories is more likely than finding any member of one of the larger, general categories.
- The conjunction fallacy demonstrates the use of the **representativeness heuristic**, making judgments of likelihood based on how well an example represents a specific category.
- **The Availability Heuristic:**
- The **availability heuristic** entails estimating the frequency of an event based on how easily examples of it come to mind.
  I.e. We assume that if examples are readily available, then they must be very frequent.
- **Anchoring and Framing Effects:**
- The representativeness and availability heuristics involve our ability to remember examples that are similar to the current situation.
- The **anchoring effect** occurs when an individual attempts to solve a problem involving numbers and uses previous knowledge to keep the response within a limited range. Sometimes this previous knowledge consists of facts that we can retrieve from memory.
- Decision making can also be influenced by how a problem is worded or framed.
- **Belief Perseverance and Confirmation Bias:**
- One cognitive bias is **belief perseverance**, when an individual believes he or she has the solution to the problem and will hold onto that belief even in the face of evidence against it.
- Belief perseverance seems to function by minimizing negative feelings while maximizing positive feelings.
- A second cognitive bias is the **confirmation bias**, when an individual searches for or pays attention to only evidence that will confirm his or her beliefs instead of evidence that might disconfirm them.
- **Module 8.3 Language and Communication:**
- **Early Studies of Language:**
- **Aphasia** is a language disorder caused by damage to the brain structures that support using and understanding language.
- **Broca's area** is the region of the left frontal lobe that controls our ability to articulate speech sounds that compose words. The symptoms associated with damage to this region are known as **Broca's aphasia**.
- **Wernicke's area** is the area of the brain most associated with finding the meaning of words. Damage to this area results in **Wernicke's aphasia**, a language disorder in which a person has difficulty understanding the words he or she hears.
- **Properties of Language:**
- **Language** is a form of communication that involves the use of spoken, written, or gestural symbols that are combined in a rule-based form.

- Language can involve communication about objects and events that are not in the present time and place. We can use language to talk about events happening on another planet or that are happening within atoms. We can also use different tenses to indicate that the topic of the sentence occurred or will occur at a different time.
- Languages can produce entirely new meanings. It is possible to produce a sentence that has never been uttered before in the history of humankind, simply by reorganizing words in different ways. As long as you select English words and use correct grammar, others who know the language should be able to understand it.
- Language is passed down from parents to children.
- Language requires us to link different sounds or gestures with different meanings in order to understand and communicate with other people.
- **Phonemes and Morphemes The Basic Ingredients of Language:**
- **Phonemes** are the most basic units of speech sounds.
- **Morphemes** are the smallest meaningful units of a language.
  E.g. Pig is a morpheme because it cannot be broken down into smaller units of meaning.
- Some morphemes are simple words, whereas others may be suffixes or prefixes.
- You can combine morphemes if you follow the rules of the language.
  E.g. Pigs is a combination of the morphemes “pig” and “s”.
  Our ability to combine morphemes into words is one distinguishing feature of language that sets it apart from other forms of communication. In essence, language gives us **productivity**, the ability to combine units of sound into an infinite number of meanings.
- **Semantics** is the study of how people come to understand meaning from words.
- Although phonemes, morphemes, and semantics have an obvious role in spoken language, they also play a role in our ability to read. When you recognize a word, you effortlessly translate the word’s visual form, its orthography, into the sounds that make up that word, its phonology or phonological code. These sounds are combined into a word, at which point you can access its meaning or semantics. However, not all people are able to translate orthography into sounds. Individuals with dyslexia have difficulties translating words into speech sounds. Children with dyslexia show less activity in the left fusiform cortex (at the bottom of the brain where the temporal and occipital lobes meet), a brain area involved with word recognition and with linking word and sound representations.
- **Syntax The Language Recipe:**
- **Syntax** is the rules for combining words and morphemes into meaningful phrases and sentences.
- **Pragmatics The Finishing Touches:**
- **Pragmatics** is the study of nonlinguistic elements of language use. It places heavy emphasis on the speaker’s behaviours and the social situation.
- Pragmatics reminds us that sometimes what is said is not as important as how it is said.
  E.g. A student who says, “I ate a 50-pound cheeseburger,” is most likely

stretching the truth, but you probably would not call him a liar. Pragmatics helps us understand what he implied.

- **Infants, Sound Perception, and Language Acquisition:**
- Infants as young as two months old show a preference for speech sounds over perceptually similar non-speech sounds.
- By 10 months of age, infants begin hearing sounds in a way that is consistent with their native language.
- Newborn infants can distinguish between function words, prepositions, and content words, nouns and verbs, based on their sound properties. By six months of age, infants prefer the content words, thus showing that they are learning which sounds are most useful for understanding the meaning of a statement.
- By the age of 20 months, the children are able to use the perceptual categories that they developed in order to rapidly learn new words.
- In some cases, children can perform **fast mapping**, the ability to map words onto concepts or objects after only a single exposure.
- Human children seem to have a fast-mapping capacity that is superior to any other organism on the planet. This skill is one potential explanation for the naming explosion, a rapid increase in vocabulary size that occurs at this stage of development. The naming explosion has two biological explanations:
    1. At this stage of development, the brain begins to perform language-related functions in the left hemisphere. Prior to this stage, this information was stored and analyzed by both hemispheres.
    2. The naming explosion has also been linked to an increase in the amount of myelin on the brain's axons, a change that would increase the speed of communication between neurons.
- **Producing Spoken Language:**
- Stages of children developing language skills

Average Time of Onset (Months)	Milestone
1–2	Cooing
4–10	Babbling (consonants start)
8–16	Single-word stage
24	Two-word stage
24+	Complete, meaningful phrases strung together

- **Sensitive Periods for Language:**
- Children pick up a language much more easily than adults because there is a sensitive period for language, a time during childhood in which children's brains are primed to develop language skills. Children can absorb language almost effortlessly, but this ability seems to fade away starting around age seven.

- **The Bilingual Brain:**
- Benefits of bilingualism:
    - Bilingual individuals are much better than their unilingual counterparts on tests that require them to control their attention or their thoughts. Bilinguals score better than unilinguals on tests of executive functions throughout the lifespan.
    - Being bilingual helps protect against the onset of dementia and Alzheimer's disease. Because the executive control involved with bilingualism uses areas in the frontal lobes, these regions may form more connections in bilinguals than unilinguals. As a result, these brains likely have more back-up systems if damage occurs.
- Although bilingualism leads to many benefits, bilingual children tend to have a smaller vocabulary in each language than unilingual children.
- People with the FOXP2 gene have difficulties with producing speech because this condition results from abnormalities involving parts of the brain that plan and coordinate movements of the lips, mouth, and tongue.

Definitions:

- **Algorithms:** Problem-solving strategies based on a series of rules.
- **Anchoring effect:** Occurs when an individual attempts to solve a problem involving numbers and uses previous knowledge to keep (i.e., anchor) the response within a limited range.
- **Aphasia:** A language disorder caused by damage to the brain structures that support using and understanding language.
- **Availability heuristic:** Entails estimating the frequency of an event based on how easily examples of it come to mind.
- **Belief perseverance:** Occurs when an individual believes he or she has the solution to the problem or the correct answer for a question and accepts only evidence that will confirm those beliefs.
- **Broca's area:** A region of the left frontal lobe that controls our ability to articulate speech sounds that compose words.
- **Category:** A cluster of interrelated concepts.
- **Classical categorization:** A theory that claims that objects or events are categorized according to a certain set of rules or by a specific set of features.
- **Concept:** The mental representation of an object, event, or idea.
- **Confirmation bias:** Occurs when an individual searches for only evidence that will confirm his or her beliefs instead of evidence that might disconfirm them.
- **Conjunction fallacy:** Reflects the mistaken belief that finding a specific member in two overlapping categories is more likely than finding any member of one of the larger, general categories.
- **Cross-fostered:** Being raised as a member of a family that was not of the same species.
- **Fast mapping:** The ability to map words onto concepts or objects after only a single exposure.

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- **Functional fixedness:** Occurs when an individual identifies an object or technique that could potentially solve a problem, but can think of only its most obvious function.
- **Graded membership:** The observation that some concepts appear to make better category members than others.
- **Heuristics:** Problem-solving strategies that stem from prior experiences and provide an educated guess as to what is the most likely solution.
- **Language:** A form of communication that involves the use of spoken, written, or gestural symbols that are combined in a rule-based form.
- **Linguistic relativity/Whorfian hypothesis:** The theory that the language we use determines how we understand the world.
- **Mental set:** A cognitive obstacle that occurs when an individual attempts to apply a routine solution to what is actually a new type of problem.
- **Morphemes:** The smallest meaningful unit of a language.
- **Phonemes:** The most basic unit of speech sounds.
- **Pragmatics:** The study of nonlinguistic elements of language use.
- **Priming:** The activation of individual concepts in long-term memory.
- **Problem solving:** Accomplishing a goal when the solution or the path to the solution is not clear.
- **Prototypes:** Mental representations of an average category member.
- **Representativeness heuristic:** Making judgments of likelihood based on how well an example represents a specific category.
- **Semantics:** The study of how people come to understand meaning from words.
- **Semantic network:** An interconnected set of nodes or concepts and the links that join them to form a category.
- **Syntax:** The rules for combining words and morphemes into meaningful phrases and sentences.
- **Wernicke's area:** The area of the brain most associated with finding the meaning of words.