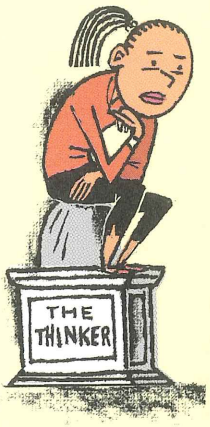
CHAPTER 9



Thought and Language

In this chapter, you will learn about:

- **the structures and processes used in thinking**
- **reasoning, problem solving, and decision making**
- **how language and thinking interact**

Think of a moderately pleasant memory—perhaps when you did something you enjoyed. In your "mind's eye," make a picture of the memory. As you look at the picture, is it in black and white or color? Is it two- or three-dimensional? Is it a movie, a series of "slides," or a photograph? After noticing those qualities, change one of them—if the picture is in color, make it black and white; if it's a movie, make it stand still. What happens to your feeling of pleasantness?

Concepts, propositions, and language—along with mental images—are among the tools people use to process information. Specific steps in thinking can help in problem solving and lead to more accurate or useful decisions.

Can you think without language? Some researchers say that we can get a "sense" of a concept without having the words to describe it, just as a young child might have a sense of what a dog is before learning the word. How do language and thought interact?

What Is Thinking?

People use the word *think* to describe a wide variety of mental processes.

"I think I was four when that happened." (Memory)

"Think!" (Attention)

"I think UFOs exist." (Belief)

"I think that's a verb." (Statement of fact)

In addition to these examples, *thinking* is used to describe mental actions as diverse as reasoning, understanding, judging, supposing, pondering, and imagining. Mental processes are referred to as cognition.

Let's define **thinking** as a set of mental activities that results in the solution of a problem or the attainment of a goal. This definition focuses on goal-directed mental processes rather than the "thinking" we do when we are daydreaming or simply noticing our environment.

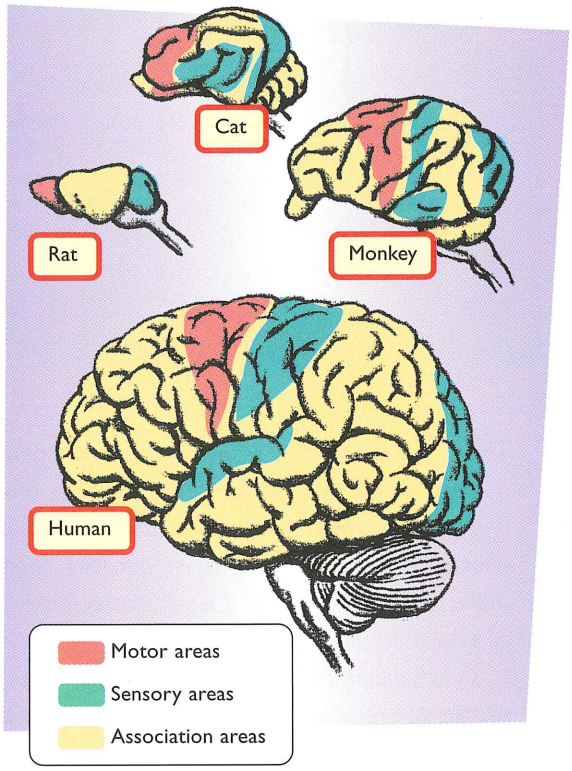
The Biological Basis of Thought

Cognitive neuroscience is the study of the biological basis of thought. Cognitive neuroscientists try to understand mental processes by studying how groups of neurons work together in specific regions of the brain to accomplish a given task and how these groups of neurons work together to generate higher mental processes.

The Thinking Brain

Although research in cognitive neuroscience is still in its infancy, **two** areas of the brain have been identified as playing important roles in thinking and higher mental processes.

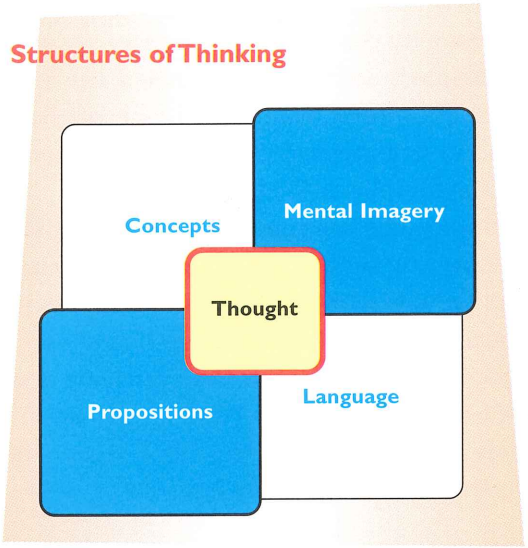
1. **Association Cortex.** Nearly three-fourths of the human cortex is made up of association areas in which bits of information from the senses and previous experience are put together. Because humans have so much more association cortex than other members of the animal kingdom, scientists conclude that these areas are involved in higher thinking processes.

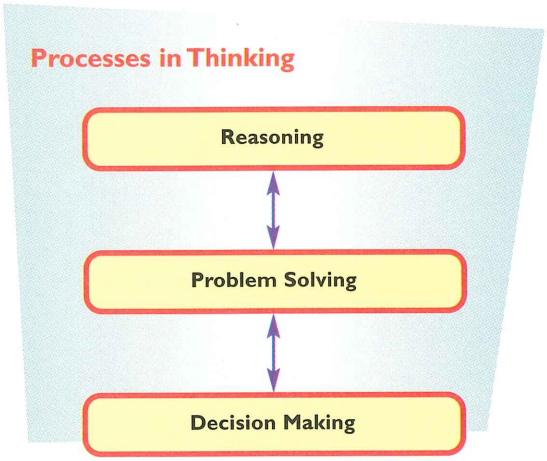


2. **Frontal Lobe.** The frontal lobe is responsible for giving humans the ability to think analytically, reason, and plan. Studies suggest that in this area of the brain different values are assigned to possible choices. People with frontal lobe damage are often unable to make decisions or make them unwisely.

The Psychological Basis of Thought

While there are many ways to organize the study of thinking, the graphic organizer below may be helpful as you study the various aspects of thought. As you read through the chapter, you may wish to create your own graphic organizer.





Structures of Thinking

Thinking is a complex process that uses many different methods. Concepts, propositions, and mental imagery are all methods used to bring structure to the thinking process.

What Are Concepts?

Imagine that each tree, each blade of grass, and each human or animal you encountered had to be processed as an individual perception. Fortunately, human minds are capable of grouping similar objects, actions, and experiences so that knowledge of one leads to knowledge or expectations of others with similar attributes.

The words *tree, grass, human, animal,* and *encounter* in the previous paragraph are all concepts. The first four words describe groups of objects with similar characteristics. *Encounter* describes a class of actions in the world.

Concepts are mental representations of classes into which we divide objects, actions, or events in the world. We use concepts to communicate, to predict, to reason—in short, to think.

The ability to form concepts is a highly adaptive behavior. Imagine the problems early humans would have had if they hadn't recognized concepts such as *tiger, food, shelter,* or *danger.*

Functions of Concepts

One important function of concepts is *cognitive economy*—the ability to sum up a lot of similar objects, actions, or experiences into a single, agreed-upon word, such as *book* or *enjoy*. Try describing your day without using any concepts!

For even greater economy, people combine concepts into larger groups. You may organize your geographic environment around a large concept of city or town, which is composed of neighborhoods. Within the neighborhood is your school, home, stores, and so on.

Where Do Concepts Come From?

In many cases, concepts are taught. When a child points to a dog, an adult says the word *dog*. If the child later misidentifies a cat as a dog, adults will correct the child. Eventually, the child learns to distinguish members of those concept groups, but how he or she learns to tell the difference isn't clearly understood.

Some theorists suggest that we begin by creating a **prototype**—an ideal example of the concept. When we see a spider, for example, we access our prototype for *bug* or *insect* and then compare the object we are looking at with characteristics of the prototype, such as *small* and *multilegged*. The more the new object has in common with the prototype, the more quickly we identify it. It takes us longer to identify a penguin as a bird than a robin because a penguin doesn't share many of the characteristics we commonly think of when we hear the word *bird*.

The meaning of a concept may differ from person to person. The spider concept of a person who fears spiders will contain different information than the spider concept of a person who collects them.

Social Concepts

Not all concepts refer to objects, actions, or experiences. Consider this example.

Social concepts deal with typical roles, personality characteristics, or other social descriptors, such as doctor, Italian, extrovert, or Catholic. Some social concepts can lead to stereotypical expectations or incorrect assumptions. While the ability to group people has cognitive efficiency, some people lose sight of the differences among individuals within the group. What does it mean to be a conservative or a liberal—a "jock" or a "nerd"—a college graduate or a self-taught individual? What images or expectations pop into your mind when you hear those concept terms?

Organization of Concepts

Concepts are grouped together in the mind in various ways depending on the object, action, or experience to which they apply. Here are **five** of the major organizing principles:

1. **Taxonomies.** A taxonomy is a hierarchical system of classification. Let's follow one branch of a taxonomy of the concept *transportation.*

Taxonomy of Transportation

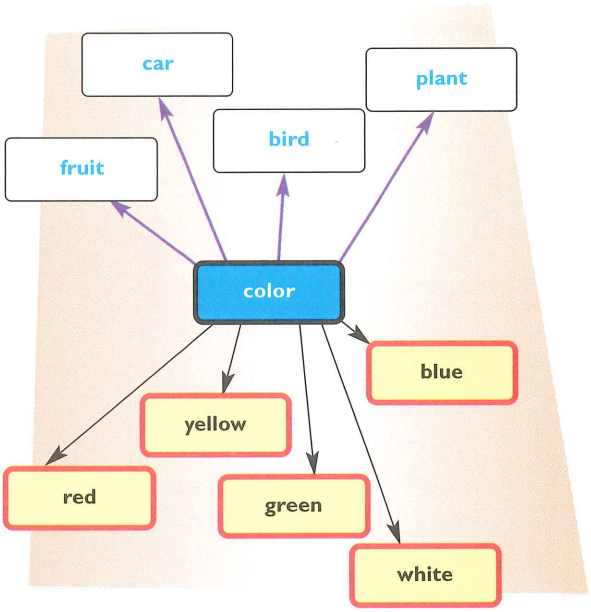
Public
Private
  Single-passenger
  Multiple-passenger
    Trucks
    Cars
      GM
      Chrysler
      Ford
        Escort
        Taurus
      Toyota

This taxonomy could have many more heads and subheads. Other branches could describe features of each item in the taxonomy, such as number of wheels, color, or dimensions.

Taxonomies are useful for organizing fairly simple concepts and their features because they provide a great deal of cognitive economy. They help to answer questions such as "Is a Taurus a form of public transportation?"(No)

2. **Networks.** In Chapter 8, you saw how semantic memories could be organized into networks. For example, you'd expect that the concepts for *red, yellow, blue,* and *green* would be stored in a cluster around the larger concept of *color,* as shown here.

Network



In turn, color could be linked to concepts whose features contain a color, such as "apples are red." Physiologically, one might imagine that each node is a set of neurons that responds in a unique way to the node's content—e.g., red. The closer together the nodes, the more quickly connections are made. "Is red a color?" will return a "yes" answer more quickly than "Can a car be yellow?"

3. **Schemas.** You may look at schemas as information about a concept gathered into a meaningful set. A schema about school would contain subschemas — concepts about classes, teachers, students, books, schedules, and other school-related information.
4. **Scripts.** A script is a concept dealing with a situation. Scripts contain a list of actions carried out for a particular purpose. You might have a "making breakfast" script, a "studying for a test" script, or a "driving the car" script. The steps in the script contain concepts for objects, actions, and events.
5. **Cognitive Maps.** A cognitive map uses mental images to show spatial relationships among concepts. For example, you probably have a cognitive map for your house and for your room within your house. These maps vary from person to person since each person has unique interests and perspectives.

Evidence for Hierarchical Storage

Why do psychologists believe that some concepts are stored in a taxonomy? If someone asks, "Did Shakespeare have an elbow?" or "Did George Washington have two lungs?" you would answer "yes" in spite of the fact that you probably never thought of either of those relationships before. The specific relationship hadn't been organized or stored in your memory.

J. R. Anderson and G. H. Bower have argued that you reason to get these answers using your knowledge that both Shakespeare and Washington were humans and that humans have elbows and two lungs. This sort of reasoning is done using a hierarchical taxonomy.

They don't suggest that all information is stored in this way, but any relationships that haven't been previously learned appear to be accessible through this type of hierarchical organization.

What Are Propositions?

Statements called *propositions* are used in some forms of reasoning. A proposition is meant to represent a true statement—a representation of things as they are. One of the most important parts of good thinking is assessing the truth of the propositions one uses.

Truth is sometimes defined as a statement that represents the world as it really is. Because the way things "really are" is not always a matter of agreement, truth is more often an agreed-upon description of "reality." One need only read the letters to the editor in the newspaper to understand that the truth of a proposition can be hotly debated.

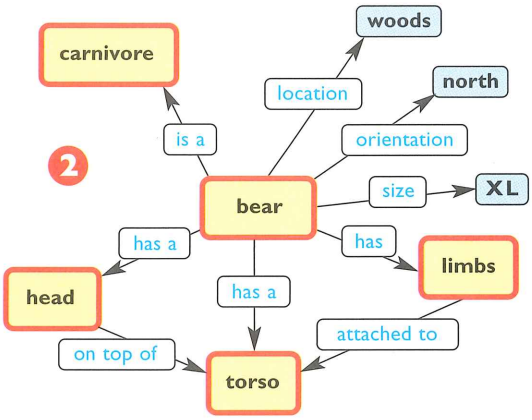
What Is Mental Imagery?

In addition to concepts and propositions, *mental imagery* plays a large part in our thinking. In a study by Stephen Kosslyn, participants were asked, "Do the ears of a beagle stick up above its head? How about a German shepherd?" Participants reported getting the answer by picturing the dog and "looking" at its ears.

Information About Space

We use mental imagery to represent information about objects in space. Spatial relationships, such as above, below, next to, and inside of, can be more easily visualized than represented as a network or taxonomy.

Which representation of a bear has greater cognitive efficiency?



The diagram (2) is based on Steven Pinker's visualization of a network made up of separate propositions, such as "A bear is a carnivore" and "A bear has a head." Although the diagram is somewhat more organized than a list of sentences, it doesn't begin to "chunk" information as well as the drawing of the bear which represents all ideas about bear in a single image.

While you can picture things that no one has ever seen, such as a 500-pound polka-dot canary, you can't picture a pencil and pen next to one another where both occupy the same space. You can change the scale or color of an object, but you can't change fundamental concepts of spatial relationships.

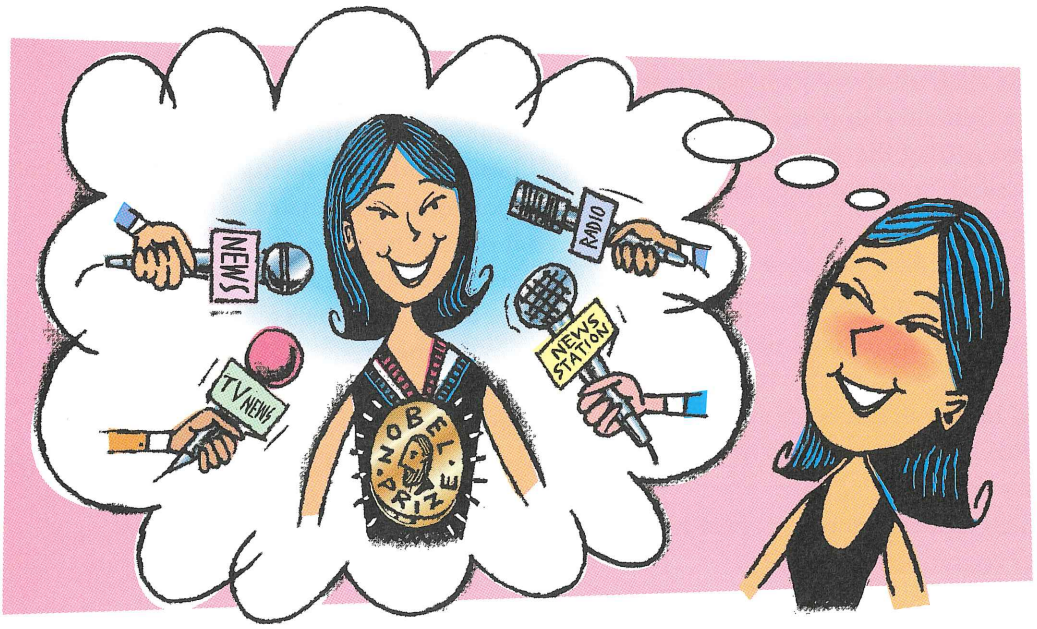
Using Mental Imagery

Make a mental image of a room in your home. Notice the placement of the furniture, the colors, even the textures in the room. Now, move the furniture, change the color, rearrange or change other features in the room. Got it? Now, turn the whole room upside down!

In addition to re-creating, changing, or rotating objects in memory, mental images allow us to imagine things we've never seen. As you make plans for your weekend, you can imagine various scenarios before actually choosing among them. Here are some other uses of imagery:

* Many creative people get their ideas through imagery. Einstein described riding on a beam of light as a source of understanding.
* Images drive emotions. People have the same physical reactions when imagining emotional scenes as when experiencing them. When asked, many people report seeing pleasant memories in color, while unpleasant memories are black and white. Changing the color qualities changes the emotion.
* Ann is taller than Carol, and Carol is taller than Barbara. Who is the tallest girl? People may picture the relationship in their reasoning.
* Some people represent complex social relationships in mental imagery. Important people tend to be larger or closer. Less important people are farther away or less bright.

A picture may be worth a thousand words, but how do your mental images, along with concepts and propositions, ultimately result in ideas and thoughts?



Processes in Thinking

While thinking itself is a relatively seamless process, psychologists tend to look at reasoning, problem solving, and decision making separately.

What Is Reasoning?

Reasoning is manipulating information in a logical way to reach a conclusion. **Logic** is a method of thinking according to a fixed set of rules.

Deductive Reasoning. Reasoning from one or more propositions to a conclusion—from the general to the specific—is called **deductive reasoning**. Assuming that the original propositions are true and the rules of logic have been applied, the conclusion must be true. For example:

All birds have wings.
A sparrow is a bird.
Therefore, a sparrow has wings.

Be careful, though, when you use deductive reasoning. If one of the original propositions is incorrect, then the conclusion may be false. For example:

All birds can fly.
Turkeys are birds.
Therefore, turkeys can fly.

All birds might have wings, but that doesn't mean all birds can fly. The reasoning of the second example is faulty, since the first premise is incorrect.

Inductive Reasoning. What is the next number in the series 1, 2, 3, 4, __ ? Most people would say "5." In **inductive reasoning**, we reason from the perceived relationships among a set of particular instances—from the specific to the general. We assume that each number in the series is one more than the previous number ($f(x) = x + 1$). There are other, admittedly more complex, equations that will yield different answers that are correct according to that equation. Induction doesn't always lead to a single correct answer.

Formal Logic

Using formal logic, reasoning proceeds according to a set of fixed rules that, when applied correctly, will always result in a true answer. These rules help one avoid logical errors such as the "turkeys can fly" case of deductive reasoning.

Analogical Reasoning. In **analogical reasoning**, we reason by comparing information with similar information from another context. Early models of the atom compared it to the solar system. The motion of the planets around the sun (a visible system) helped people to imagine the motion of electrons around the nucleus (an invisible system).

Informal Reasoning. A headline reads, "A downtown jewelry store was robbed. A suspect was on a bus at the time of the robbery." People access the following "fact" in their semantic memory: People can't be in two places at the same time.

Based on this informal reasoning, most people might conclude that the suspect is innocent. Informal reasoning works on the basis of probability rather than rules of logic. It often results in correct conclusions, but it isn't infallible. Can you think of any way that the suspect might actually be guilty of the crime?

Cultural Differences in Reasoning

The processes of reasoning tend to be fairly common across cultures, but a number of factors can influence the results of reasoning. Results of reasoning—conclusions—may be limited or enhanced by their moral or ethical acceptability within the culture. The logical punishment for stealing in some cultures is having one's hand cut off—not an acceptable conclusion in most Western cultures.

What Is Problem Solving?

We spend a good part of our lives solving problems. **Problem solving** involves changing a situation from its present state to a desired state determined by some goal. Good problem solvers begin with **three** steps—often unconsciously:

1. Represent the problem.
2. Generate and evaluate strategies.
3. Generate solutions.

Represent the Problem

Successful problem solvers spend more time analyzing and representing the problem than they do generating solutions. Let's say that your problem is a cash shortage at week's end. Consider these **four** steps in representing the problem:

1. **State a Well-Structured Problem.** Unless you clearly define your present and desired states, it's easy to get off track. What is the present state? How much money do you have? What does "shortage" mean? What is the desired state? How will you know that you've reached the desired state?
2. **Concentrate on the Appropriate Variables.** Focusing on the amount of money you can earn baby-sitting or mowing lawns during the week is more productive than focusing on the possibility of a large inheritance.
3. **Eliminate Nonessential Information.** Focus your thinking on ways to solve the problem. What you'll do with the money when you get it isn't important at this stage.
4. **Identify Resources and/or Limitations.** What skills do you have that might help you increase cash flow? Do you have any time constraints that would prevent certain solutions?

Generate and Evaluate Strategies

A **strategy** is a systematic plan for generating solutions. The following chart shows some of the strategies typically used in problem solving.

Four Strategies to Problem Solving

Algorithms

An algorithm is a step-by-step approach to problem solving. Some algorithms involve simple trial and error. If X is a possible solution to a problem, the algorithm for a solution might be stated "Try X; if X works, then X = solution; if X doesn't work, then try next X." Clearly, this could go on as many times as there is another possible X. Algorithms guarantee a solution but can be very time consuming.

Heuristics

A heuristic is a procedure that has worked in the past and is seen as likely to work in the future. Heuristics are "rules of thumb" based on past experiences. If the light in your room goes out, you could check the fuse box, change the light bulb, check the wires in the wall or lamp, check the socket, and so on. Because experience suggests that the probability of the light bulb burning out is higher than the other choices, you try that first. Heuristics take less time than algorithms, but they may not result in a solution.

Means-End Analysis

Keep the final goal in mind while setting subgoals. In planning your study for finals, you might start with math but will set a time limit because you have exams in three other subjects. Will you need to spend the same amount of time on each? What exactly do you need to focus on?

Working Backward

Start from the goal state and work backward until you reach the present state. When a company wants to know how its competitor's product works, it will "reverse engineer" that product. This means beginning with the product and analyzing its construction to see what each part does. The company can then begin with its own parts and reconstruct a similar product.

Blocks to Effective Thinking

Human thinking isn't always based on fact and reason. Here are a few problems that affect our strategic thinking.

* ***Mental Set.*** A tendency to perceive or respond to something in a fixed way is a mental set. You have a corked bottle and a dime. The dime just fits through the opening of the bottle when it is uncorked. How can you put the dime in the bottle without removing the cork or breaking the bottle? Many people get stuck on this one because they have a mind-set that defines "removing the cork" as pulling it out. Try pushing it in!
* ***Functional Fixedness.*** The tendency to perceive an object only in terms of the use for which it is designed is called functional fixedness. One man, trapped in the trunk of a car, survived when he realized that he could let the air out of the spare tire when the breathable air in the trunk ran out.
* ***Availability Heuristic.*** The tendency to assign a higher priority to information we have encountered recently is called

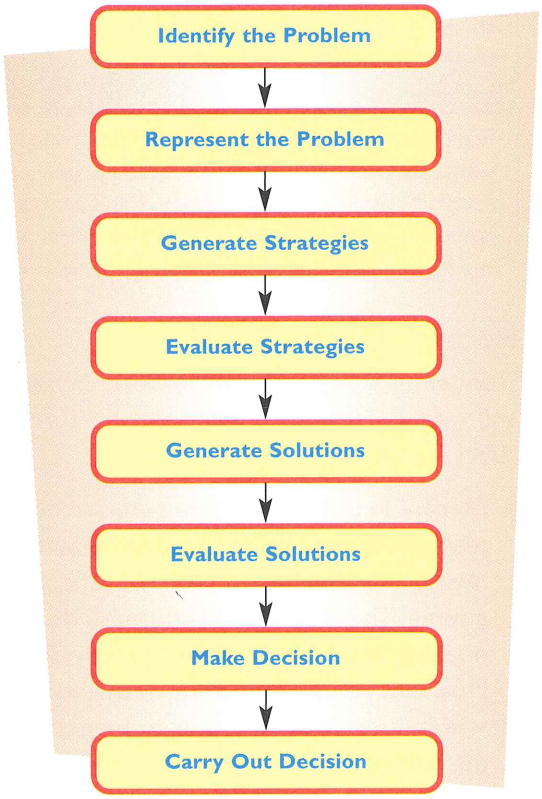
availability heuristic. Let's say that your problem involves making a choice among various forms of transportation. If there have been several air disasters in the news recently, your heuristic might exclude air travel despite the fact that it is one of the safest modes of travel.

* ***Confirmation Bias.*** The tendency to perceive or seek out information that supports what a person believes and to ignore information that does not is called confirmation bias. For example, when people or organizations that support one side of a voting issue cite experts on the topic, they tend to quote only those experts who provide evidence for their position, not those who disagree. They may, in fact, not even look for evidence to the contrary because they are already convinced of their position. When confronted with contrary evidence, they will find reasons to discount it. "Don't confuse me with the facts. My mind is made up."
* ***Representativeness Heuristic.*** The tendency to think that a particular instance will be like the prototype for that category is called representativeness heuristic. You have a problem with your car. Your two possible sources of help are a man with dirty fingernails or a well-groomed woman. Most people would first approach the man for help. If it turns out that he knows nothing about cars, you would limit your solutions if you assumed that the woman couldn't possibly help you. Stereotypical expectations often limit problem solving.

Generate Solutions

Using whatever strategy or set of strategies you consider appropriate, you generate a set of solutions. Some solutions will be better than others in terms of possibility, probability, or their effects on other circumstances in your life. To solve your limited cash problem, winning the lottery may be a possible solution, but not a probable one. Working longer hours may be possible, but will certainly have an impact on your social life. So after generating solutions, the next step is to evaluate those solutions and make your decision.

Steps in Problem Solving

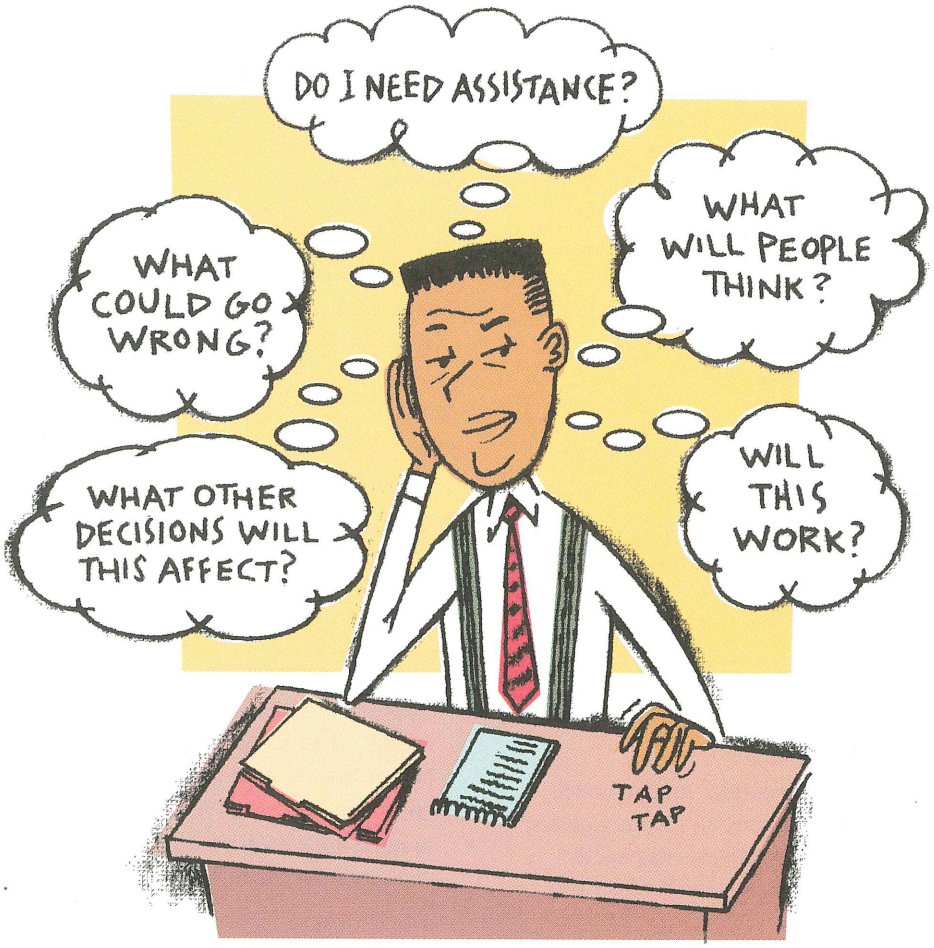


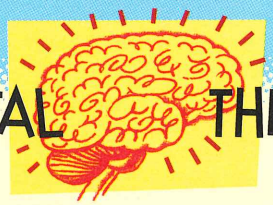
What Is Decision Making?

In general, decision making occurs when you have a number of possible choices and you must settle on a single one. Selecting what to wear in the morning or what to eat for breakfast are forms of decision making.

Although decision making is listed as a separate process of thinking, it is also part of problem solving. After generating solutions, you must decide among them. Asking the right questions about your solution is as important as representing your original problem well. Before making a decision, ask the questions shown here.

Recall the problem at the beginning of this section—too little money left at the end of the week. Take that problem, or one that is presently important to you, and follow the steps to solve it. Remember to check for potential blocks to effective thinking that you might tend toward. After generating and evaluating your solutions, make your decision.





How Can Other People Influence Your Thinking?

Are you more likely to buy a product that is good for you or one that tastes great? Are you more likely to vote for a candidate who stands for higher wages or protecting the environment? What words or phrases affect your thinking? Consider the issues and yourself.

THE ISSUES

You have read about a number of ways that people limit or distort their thinking. Another interesting behavior results from what's called the *framing effect*, the use of words or phrases that tap into people's values or preferences. Advertisers, politicians, and even parents may use the framing effect to influence the choices people make. For example, before an election year, political groups will conduct a poll to determine the major issues that concern people, such as the economy, jobs, education, or wilderness conservation. They'll then make sure that candidates use those catch words or phrases in their speeches. Basically, they're just repeating back what you've told them is important. Advertisers also do market research to determine why people buy certain products. What words on a label or in a TV or print ad will make you want to buy the product? Should they use *hearty* or *filling* to describe soup; *lite* or *low-calorie* to describe salad dressing; *reliable, sleek,* or *exciting* to describe a new car? Depending on their values, different people will respond in different ways to such terms, but research will generally discover the catch words that "frame" a product or a candidate in a way that will appeal to a majority of people.

Smart parents know that to get a child to eat a particular food, telling the child that it is healthy isn't nearly as successful as describing how good it tastes.

How can other people influence your thinking?

THE PROCESS

1. **Restate the question.** In your own words, state a question about words that attract you.
2. **Provide evidence.** From your own experience and from the information above, list some catch words or phrases that influence your thinking *positively.*
3. **Give opposing arguments.** From your own experience and from the information above, list catch words or phrases that influence your thinking *negatively.*
4. **Look for more information.** As you watch TV or read print ads or articles about politics, notice which words or phrases appeal to you and which do not. Research *advertising psychology* and the *framing effect* in the library or on the Internet.
5. **Evaluate the information.** Make a chart with two columns:

Words and Phrases	
Positive	Negative

Record the words and phrases in each column. Think about why each word or phrase affects your thinking as it does.

6. **Draw conclusions.** Write one paragraph supporting your answer to the question "How can other people influence my thinking?"

Language and Thought

Our ability to use language sets us apart from other animals. Humans use language not only to think but also to share the results of their thinking with other humans. Language conveys information about everything from concrete objects and events to abstract concepts such as truth and beauty.

Which Comes First?

Can we think about a concept without language? The human tendency to organize the world is at work even in the smallest child. The child has a sense of "dogness" before learning the word *dog*. When the child later uses the word *dog* to refer to a shaggy rug, adults can correct the misconception—again in language. Thought and language work together. The more complex the concept, the more precise the language we require to express it.

Elements of Language

There are several elements of language:

Phonemes. Because spoken language came before written language, the sounds that we are able to make become the units of language. These basic units of sound are called phonemes. Phonemes are strung together to make words. The one-syllable word *spoon* contains four phonemes—the /s/ sound, the /p/ sound, the /oo/ sound, and the /n/ sound. Humans can produce about 100 phonemes, although we only use a portion of them in speech.

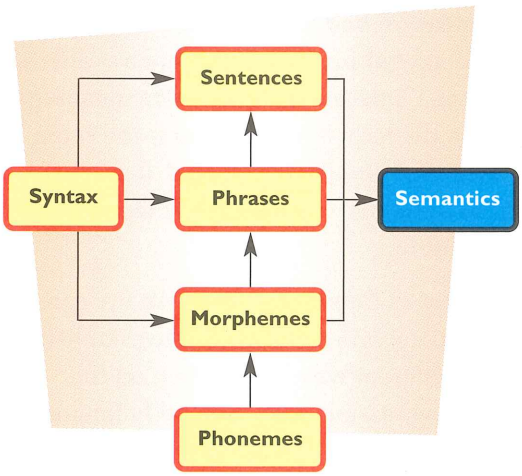
Morphemes. Just as phonemes are the basic units of sound, morphemes are the basic units of meaning—words.

Phonemes must be combined in specific ways to become morphemes. A *bound morpheme* is a word that conveys meaning, such as *rest*. By combining morphemes with suffix or prefix phonemes, we can describe an event that is happening (such as "resting") or has happened (such as "rested").

Syntax—Phrases and Sentences. A phrase is a simple combination of words, such as "the blue coat," while a sentence is usually a complete thought. Syntax is the set of implicit and explicit rules by which we combine words, phrases, and clauses to produce sentences. These can be correctly combined in a number of ways to achieve the same meaning.

Semantics. At each level, from morphemes up, semantics is a set of rules and conventions for how to convey meaning.

The following illustration shows how the elements of language are related.



Languages differ in two ways. The lexicon of the language is the set of words used in that language. The grammar of the language consists of the rules for combining those words and for expressing semantic concepts.

Meaning and Understanding

Semantic factors that affect understanding include:

Context. You tell a friend that you met the President yesterday and she says, "Sure, and I won the lottery." Did she really win the lottery? No. She is matching what she perceives as an exaggeration with another exaggeration. As we gain more experience with language, we begin to understand the contexts in which it can be used.

Talking Up or Down. We may express an idea using "baby talk" to a young child and more complex language to an educated adult. Although we are using very different tone and words, with experience, people may perceive the same meaning in both forms of language.

Denotation and Connotation. *Denotation* is the agreed-upon definition of a word or phrase. *Connotation* carries extra meaning. While the term *crippled* denotes the same thing as *physically handicapped,* it connotes something that is considered inappropriate or insulting.

Nonverbal Communication. We interpret the same words spoken by two people in very different ways depending on the facial expression, tone, and body language of each person. How do you know the difference between the word *Right* when said by a teacher after you answer a question correctly and *Right* spoken by a person who doesn't believe what you just said?

How Is Language Acquired?

In the 1950s and 1960s, psycholinguist Noam Chomsky and behaviorist B. F. Skinner debated about how children acquire language. Chomsky argued that human children are born with language ability and actively figure out language on their own. Skinner insisted that children acquire language through shaping and conditioning.

In *The Language Instinct,* psycholinguist Steven Pinker picks up Chomsky's argument. He points out that children typically grasp the rules of plurals and tenses very early in life. If *dog* becomes *dogs,* then *mouse* becomes *mouses*—just add an *s.* After you cooked dinner, you eated it—add *-ed* to make a past tense. Pinker asks where children learn these rules. A parent might correct a child who calls a dog a cat but may rarely tell him or her how to form plurals or past tenses. The child does that alone.

On Skinner's behalf, it's clear that a child's environment contributes to his or her vocabulary and grammatical repertoire. Studies have shown that a fetus may well hear and learn to recognize the inflections of his or her native language prior to birth. After birth, the infant shows a preference for speakers of that language.

Today, many believe that humans have an innate capacity for language in structures "hard-wired" into the human brain that provide the basic mechanisms for language.

The environment, particularly during the early years, fine-tunes the lexicon, grammar, and even our perceptions of sound.

As an example, the Thai language contains sounds English speakers call "half-tones"—pitches halfway between the tones that westerners normally use in speech. Researchers have found that, when western adults try to learn the Thai language, they are unable to perceive the half-tones, much less reproduce them. Although westerners are born with the capacity to hear those tones, their neurons have either been "tuned" to different tones or have disappeared because there was nothing in the environment to activate them.

Language and Concepts

Does language affect our ability to form concepts? Some languages have as few as two words to describe colors. Studies focusing on different aspects of color perception and recall have demonstrated that, regardless of the number of words a language has to describe colors, the ability to perceive colors is independent of being able to name them. One possible explanation for this is that all humans have the same physiological system for the perception of color.

What about other concepts that aren't dependent on a physiological system? For example, in English, we would say, "If I had the money, I would buy a car." In Chinese, this would be "If I have the money, I will buy a car." In English, you can conclude that you don't have the money. In Chinese, that conclusion isn't obvious.

It would appear that, in some cases, the lexicon and grammar of a language does affect the way in which a person is able to think.

What Must a Language Do?

Deaf people who use American Sign Language show that they are capable of the same complex cognition as people who use spoken English. While some form of language seems to be necessary for such cognition, it need not be spoken. It must, however, provide people with a way of communicating and of manipulating symbolic information.

Bilingualism and Culture

In the 1950s, linguist Benjamin Whorf proposed that language shapes the very ideas that people can have, as well as their perceptions. Here are **two** examples:

EXAMPLE 1: Cultures that live near and make their living from the ocean have many more words for ocean conditions—such as tides or waves—than cultures that live inland. An inland person doesn't need to use differences in ocean conditions to make decisions and, therefore, doesn't even perceive them.

EXAMPLE 2: English has many words to describe how one feels—self-focused emotions, such as anger or irritation. Japanese and other collectivist cultures have many words for emotions related to others, such as sympathy or concern.

Studies have shown that learning to think in the language of a culture that prioritizes concepts differently from your own helps you to understand more about your own thinking. Knowing another language also broadens one's outlook on how concepts affect perceptions and reasoning.

The ability to learn language is especially strong early in life. Second languages are more easily learned in childhood and adolescence.

Language Influences Thought

Although many scientists disagree with Whorf's proposition that language determines our thoughts and ideas, we can probably agree that language influences what we think. Today's concerns over "political correctness" in language demonstrate how our thinking changes when, for example, a female adult is referred to as a *girl* rather than a *woman.*

Language in Animals

While animals certainly communicate, questions remain about whether they truly use language. Attempts to teach human language to animals have been met with mixed reactions from scientists who disagree about how *language* is defined. Further, people who believe that the use of language separates us from other animals resist the idea that animals truly use language.

If we define language as the ability to manipulate symbols and use them to communicate, then it would appear that species such as dolphins, parrots, and chimpanzees use and understand language. They not only recognize and respond correctly to vocal and symbolic commands, but they use symbols to generate unique sentences.

Chimpanzees can be taught to use symbols representing objects and events in their environment. Some learn to use computer keyboards containing symbols to flash messages on a screen. Others have been taught sign language. One of the most famous, a female chimp named Washoe, has learned well over 200 different signs. Washoe combines the signs into meaningful sentences, such as "more banana" or "please sweet drink." Further, Washoe's baby quickly learned over a hundred of the signs from Washoe, and the two were seen communicating with each other using signs.

Although animals may use symbols to form meaningful sentences, they haven't shown the ability to use human language beyond the level of a young child. Further, animals learn the symbols themselves through operant conditioning. Using the symbols to generate new sentences correctly is reinforced with rewards, while human children seem to have an innate need for language. Whether animals are merely responding to conditioned behaviors or are truly using language to communicate will require more study.

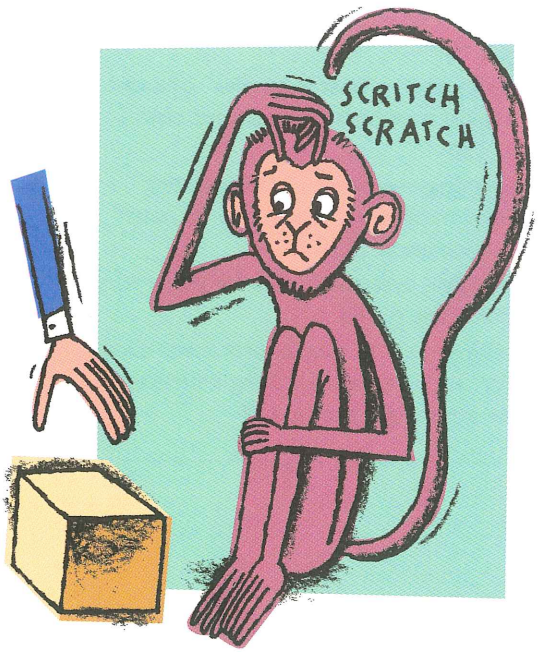
Thought in Animals

With or without language, animals have shown surprising levels of thinking. Both chimpanzees and tamarin monkeys show evidence that they are aware of what another being knows or should know.

Chimps will warn another animal when they see something they realize the other animal hasn't seen.

A tamarin monkey will act surprised when a human behaves in a manner inconsistent with what the monkey thinks the person should know. For example, an apple is removed from under a box in the presence of both the monkey and the person. If the person later reaches under the box for the apple as if it were still there, the monkey adopts a position that researchers have identified as "surprise."

Research in animal thinking is restricted only by the cleverness of research methods that limit the interpretation to actual thought rather than stimulus-response or instinct.



Current Research in Thinking

Linguist George Lakoff and philosopher Mark Johnson have recently combined research from multiple fields to suggest other ways of understanding thought and language.

Citing evidence from cognitive and evolutionary psychology, Lakoff and Johnson suggest that thought and reason are adaptations that are dependent on the nature of the body. Many concepts arise from our perceptions of the relationships of objects and events to our bodies. Examples include in and out, front and back, and large and small.

Lakoff and Johnson also maintain that our language is largely metaphoric, suggesting that we tend to think about even abstract ideas as objects that can be perceived and manipulated:

"Tomorrow is a big day."

"You're in trouble now."

"Give me your thoughts about that."

Is tomorrow really bigger than today? Is trouble a substance? Do you hand me your thoughts? Although none of the sentences is literally true, we easily understand them.

These are just a few of the ideas challenging cognitive psychology today. While the new tools of cognitive neuroscience and psychology have increased our understanding of thinking and language, much clearly remains to be learned.

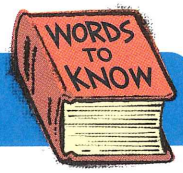
Chapter 9 Wrap-up

THOUGHT AND LANGUAGE

Humans use concepts, mental imagery, propositions, and language in thinking processes. Information is stored in taxonomies, networks, schemas, scripts, and cognitive maps. Thought processes include reasoning, problem solving, and decision making. Good problem solvers either consciously or unconsciously follow a series of steps designed to identify and evaluate potential solutions or goal approaches.

Language is constructed from phonemes, morphemes, phrases, and sentences. By following explicit or implicit rules for the encoding and understanding of information contained in language, humans manipulate and communicate ideas. Even unspoken languages, such as American Sign Language, allow complex conceptual thinking.

Psychology



analogical reasoning—process of reasoning by comparing information with similar information from another context. *p. 141*

concepts—classes in which we represent and organize the world. *p. 135*

deductive reasoning—process of reasoning from the general to the specific, from one or more propositions to a conclusion. *p. 141*

inductive reasoning—process of reasoning from specific instances to a generalization. *p. 141*

logic—method of thinking according to a fixed set of rules. *p. 141*

problem solving—reasoning to change a situation from its present state to a desired state determined by some goal. *p. 142*

prototypes— "best examples" or most typical members of a concept class. *p. 136*

reasoning—process of manipulating information in a logical way to reach a conclusion. *p. 141*

strategy—systematic plan for generating solutions. *p. 142*

thinking—set of mental processes used for the purpose of solving a problem or attaining a goal. *p. 134*