CHAPTER 7—COGNITION: THINKING, INTELLIGENCE, AND LANGUAGE

YOU KNOW YOU HAVE MASTERED THE MAIN TOPICS IN THIS CHAPTER IF YOU ARE ABLE TO. . .

- Introduce cognition, as it relates to mental images, concepts and problem solving.
- Describe factors that limit the ability to solve problems and the characteristics of creativity and creative thinking.
- Define intelligence, and describe several prominent theories of intelligence.
- Describe approaches to measuring intelligence.
- Outline intelligence test construction issues including reliability, validity, standardization, and how culture influences intelligence.
- Discuss the concepts of intellectual disability, giftedness, and emotional intelligence and the influences of heredity and environment on their origins.
- Explain the basis of language and the relationship between language and thought processes.

RAPID REVIEW

Thinking, or **cognition**, can be defined as mental activity that goes on in the brain when a person is processing information. Cognition includes both verbal and nonverbal processes. Two examples of cognition are **mental images**, which are picture-like representations that stand in for objects or events, and **concepts**, or ideas that represent a class of objects. Concepts can be ranked from general to specific by applying the terms **superordinate**, **basic level type**, and **subordinate**. **Formal concepts** are defined by specific rules, while **natural concepts** are formed as a result of experience. A **prototype** is a specific example of a concept that closely resembles the defining features of a concept. Concepts are formed through experience and culture and have an impact on our thinking.

Problem solving involves using our thoughts or cognitions to reach a goal and consists of at least four different techniques. **Trial-and-error** problem solving makes use of mechanical solutions. When someone uses **algorithms** to problem-solve they are following step-by-step procedures to solve the problem. **Heuristics** are general "rules of thumb" that can be applied to many situations. **Means-end analysis** is an example of one type of heuristic where the difference between where you are and where you want to be is determined and then steps are taken to reduce that difference. **Insight** consists of solving the problem by having a sudden moment of inspiration or "aha!" moment. **Artificial intelligence** is the creation of a machine that can think like a human and is represented today through computer program such as Deep Blue.

Some factors that interfere with problem solving include **functional fixedness**, which is when a person thinks about objects only in terms of their typical uses; **mental sets**, which are tendencies to use the same problem-solving strategies that worked in the past; and **confirmation bias**, which consists of the search for evidence that fits your beliefs while ignoring any contradictory information. **Creativity** occurs when a person solves a problem by combining ideas and behaviors in a new way. Many methods of problem solving utilize **convergent thinking**, which assumes that one single answer exists for the problem. **Divergent thinking** is the opposite process of convergent thinking. When an individual uses divergent thinking, he or she starts from one point and comes up with many possibilities or ideas based on that point.

Intelligence can be defined as the ability to learn from one's experiences, acquire knowledge, and use resources effectively in adapting to new situations or solving problems. Currently, there is still much disagreement on exactly what is meant by the term "intelligence" In 1904, **Charles Spearman** proposed that intelligence was split between two abilities. The first ability was a general intelligence, labeled the **g factor**, and the other was a specific intelligence referred to as the **s factor**. Spearman believed that both the g and s factors could be measured using standardized intelligence tests. **Howard Gardner**, on the other hand, proposed that at least nine different kinds of intelligence exist. **Robert Sternberg** proposed the **triarchic theory of intelligence**, which states that intelligence can be divided into three types: **analytical**, **creative**, and **practical intelligence**.

The study of cognitive psychology and memory has come a long way in the past 30 years. We have developed models of memory that help us understand why people remember things, why people forget things, and why, sometimes, we need to work to learn things. In general, it is best to keep in mind that no matter how recent your textbook is, new information is constantly evolving about memory. It is one of the bigger areas of study today, and as we learn more and more about how the brain works, we will develop better and more complete models of memory.

AP EXPERT TIP

Following a recipe to bake a cake is an example of an algorithm.

WHAT IS LANGUAGE?

Language is a complex communication system that involves the use of **abstract symbols to convey unlimited messages.** By that definition, then, we have to leave out most of animal communication. There are limits to what animals can communicate to each other.

Human language, however, can convey meaning about things that haven't happened yet, things that happened in the past, and things that may never happen. Because we can transcend time and space with language, we have unlimited ability to communicate ideas.

How is language structured? According to many linguists and psycholinguists, language is a **multilayered process.** We start with phonemes. A **phoneme** is the smallest unit of *sound* in a language. All the letters of the alphabet are phonemes (though there is some overlap—*c* can make the *k* or the *s* sound, for example). In English, we produce all the unique sounds that we are able to make by combining only about 40–50 unique phonemes. Other languages make do with less. Hawaiian has fewer than 30 phonemes.

The next level of language is the morpheme. According to linguists, **morphemes** are the smallest unit of *meaning* in a language. Small words, such as *cat* or *walk,* are morphemes. If we add the letter *s* to *cat*, we now have two morphemes (*cat*(*s*)), and if we add–*ing* to *walk*, we have two morphemes (*walk*(*ing*)). Many words are composed of a variety of morphemes combined to produce a unique meaning.

To be a language, there must be **grammar**, which refers to the system of rules that are used in a particular language. One of those sets of rules is called **semantics**, which is the way we understand meaning from words by their morphemes and from the context. We know that adding an –*s* to the end of a word means that we are referring to more than one, or we know that words can have different meanings depending on the placement in a sentence or on the context. "I'm dying!" has a very

different meaning when said by a person who is bleeding on the ground versus an adolescent preparing for her first middle school dance.

Another set of rules is called **syntax**. These rules refer to the way we order words to create meaning. "Your new please away shoes put" makes us confused, whereas "Please put away your new shoes" is quite clear. Different languages use syntax in different ways, so speakers of German normally use their main verbs at the end of a sentence, while in English, action words are almost always near the beginning.

HOW WE LEARN LANGUAGE

Learning language is an issue that has been rife with controversy in psychology. The behavioral approach posits that we learn language the same way we learn anything else: We are **exposed to things in the environment, and if they are reinforced, we repeat the behavior**. Nativists, however, would argue that we are "**hardwired**" to learn language and that humans are unique in this respect. Both sides have their ardent supporters, and the evidence has not yet clearly settled the debate.

LANGUAGE ACQUISITION

According to linguist **Noam Chomsky**, language is learned by exposure to language, but the ability to speak is hardwired. That is, humans are born with the innate ability to speak, and the environment helps that skill emerge. Chomsky argues that the behavioral approaches do not take into account the fact that we learn language differently than we learn other things.

According to Chomsky, there is a **critical period** of language acquisition, and if we do not learn language during that time, we will not learn language well. There is overwhelming evidence to support this, yet Chomsky's argument about the speed with which we learn language may be overstated.

It is true that only humans learn language and that only humans learn to speak without being specifically taught language. However, human learning is more complex than simply learning connections between behavior and consequences. Often, reinforcement can be more subtle.

Suppose that, during a course of babbling, a child utters a sound that approximates a word. The parent will provide reinforcement for the utterance by praising the child. The word then becomes self-reinforcing. In such a way, words will continuously be added to the child's vocabulary.

Regardless of how a child actually learns language, the pattern of language acquisition is remarkably predictable.

Age	Milestone
Birth to 2 months	Cooing
2 months to 12 months	Babbling
Approximately 12 months	First word (typically a simple sound such as "da")
Approximately 16 months	Two-word utterances
2–6 years of age	Add 6–10 new words per day; learn grammar Overextension ("doggie" for every four-legged animal)
Age 5	Over-regularization: "I goed to the store."
From age 5 on	Add words to vocabulary; learn subtleties of language

This pattern is not predictable only in English. Other languages show the same pattern of language acquisition. In addition, children seem to follow the rules of language at about the same time. If children are told that they are looking at a "wug" and are then asked what one would say if there were two of these critters, they will say "wugs." Further, if they are told that a person will "wik," they will generate the forms "wiked" and "wiking." Thus, they seem to learn the rules that they can apply where appropriate.

LANGUAGE AND THOUGHT

A frequent debate arises in psychology over the relationship between language and thought: do our words shape the way we think, or do we have ideas first and then look for ways to articulate them? Linguist Benjamin Whorf believed it was the former; his theory of **linguistic determinism** said that our words shape and restrict our thinking. Many psychologists today have done research to show that while our language may not determine how we think, it may influence us. For example, the use of the word "he" when one means "he or she" makes one's reader far more likely to assume that the author is referring to a male.

LINGUISTIC UNIVERSALS

Children learn language in predictable ways, and, taken further, all languages across cultures have characteristics in common. There are, in fact, over a dozen linguistic universals. A few are presented here to illustrate the unique properties of human language.

Arbitrariness

Language is arbitrary. In other words, words are not inherently imbued with meaning. They are selected to stand for objects in the world in an arbitrary manner. *Dog* in English is *chien* in French.

Neither word is better than the other, but as speakers of English and French, we have agreed to call canines *dogs* and *chiens*, respectively.

Displacement

Language allows us to talk about events that have already happened, events that will happen, and events that may not happen at all. No other form of communication allows for this.

Vocal-Auditory Channel

All languages in all cultures rely on the vocal-auditory channel as the primary form of communication using language. Other forms are possible, such as sign language, but these are used only in situations when the vocal-auditory channel is somehow compromised.

There are many more linguistic universals. However, this list represents some of the most important for distinguishing between human language and other forms of communication.