

## Lesson 2

# Left Brain/Right Brain



### Key Words

analysis  
bilateral transfer  
cognition  
complementary  
corpus callosum  
dominant  
global  
hemisphere  
local  
specialize  
synchronize  
synthesis

### What You Will Learn to Do

- Distinguish between the functions of left brain and right brain

### Linked Core Abilities

- Apply critical thinking techniques

### Skills and Knowledge You Will Gain Along the Way

- Identify the activity descriptions and functions of brain hemispheres
- Describe the differences between global and analytical thinking
- Explain how brain dominance helps determine personality and behavior
- Determine personal information processing preferences
- Define the key words contained in this lesson

## Introduction

There are two sides to the brain: the left side, and the right side. In this lesson, you learn why the brain is divided into two distinct sides, and which side of the brain controls specific activity, such as creative ideas and objective, analytical thought. You also learn about split-brain research as well as the brain hemispheres.

## Visualizing the Brain

Can you imagine what your brain looks like? Close your eyes for a few seconds and visualize it positioned in the space inside your head; then, open your eyes again.

What did you see? As shown in Figure 2.2.1, your brain looks like an English walnut with the shell removed. It has a deeply wrinkled surface with a clearly marked fold that divides it into a left and a right half.

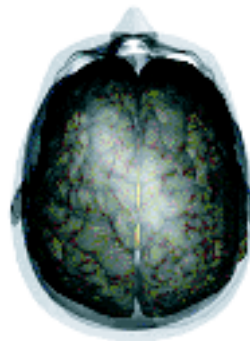
Another way to visualize what your brain looks like is by doing the following demonstration. Make a fist with both hands and put them together in front of you, about chest high and knuckles up. Look down at your fists. This will give you an idea of the physical appearance of your brain. From this view, you can clearly see the separation between the left and right halves. Figures 2.2.2 through 2.2.5 show other views of the brain.

Why is the brain divided into a left and right side? For hundreds of years, scientists believed that the two sides were mirror images of each other. Because nature equips us with two eyes, ears, legs, and kidneys that perform the same function, why not both sides of the brain?

Only within the last 40 years has science shown that the left- and right-brain **hemispheres** have unique and specific functions. Before this breakthrough, brain function was a mystery. More than 90 percent of all science known about the brain is directly or indirectly related to left-brain/right-brain research, which scientists also refer to as split-brain or hemisphere specialization research.

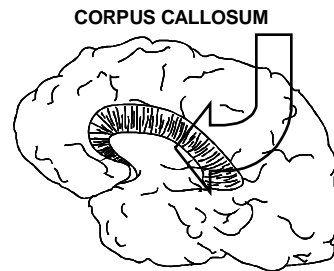
### Key Note Term

**hemispheres** – each half of a symmetrical shape



*Figure 2.2.1: The wrinkly surface of the human brain.*

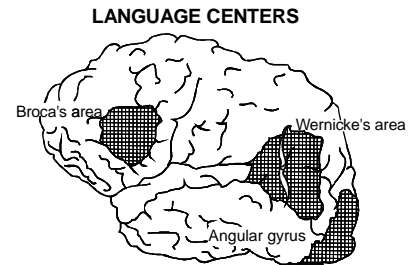
Courtesy of CACI and the U.S. Army.



The corpus callosum is the bundle of fibers that connects the two hemispheres.

*Figure 2.2.2: View of the corpus callosum.*

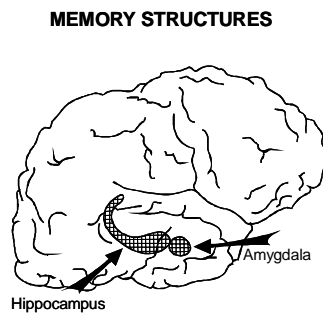
Courtesy of CACI and the U.S. Army.



The language centers (Broca's area, Wernicke's area and angular gyrus) are usually located in the left hemisphere.

*Figure 2.2.3: The language centers of the brain.*

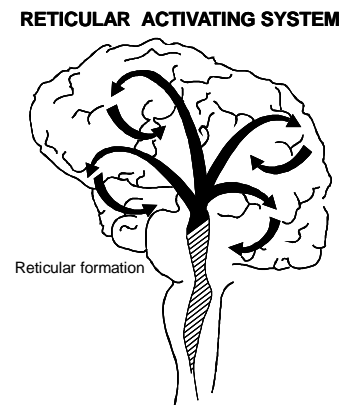
Courtesy of CACI and the U.S. Army.



The amygdala and hippocampus located in the midbrain are responsible for transforming short-term memory into long-term memory.

*Figure 2.2.4: The memory structures of the brain.*

Courtesy of CACI and the U.S. Army.



The reticular formation (or reticular activating system) is the seat of consciousness that is responsible for mental alertness, and it connects the conscious and subconscious minds.

*Figure 2.2.5: The reticular activating system.*

Courtesy of CACI and the U.S. Army.

## Split-Brain Research

In the 1950s and early 1960s, neurosurgeons who were treating patients with uncontrollable epileptic seizures decided to perform a radical type of brain surgery. They completely separated the two halves of the brain, creating a split brain, by cutting through the **corpus callosum**, the bundle of fibers that connects these halves. To the doctors' surprise and pleasure, these patients suffered no change in intelligence, personality, or daily function and their seizures stopped.

However, split-brain patients did report oddities and curiosities. For example, one patient had difficulty learning to associate names with faces. Many patients reported subtle memory difficulties, and most patients complained that they no longer dreamed. These reports initiated a tremendous interest in research, thus creating a rapid buildup of knowledge about the brain.

### Key Note Term

**corpus callosum** – the bundles of fibers (axons) connecting the two sides of the brain; white matter

Research in sleep labs proved that split-brain patients do indeed dream, which is indicated by a special brain wave pattern and rapid eye movement below the closed eyelid. These patients could not remember their dreams because one side of the brain is responsible for dream activity and the other side records the dream into words. Because the doctors had disconnected the two sides, the brain could not share this information between the two hemispheres.

Other research suggested that the two sides of the brain have a specific set of functions. Victims of automobile accidents with injuries to the left side of the head lost the ability to speak, but they could still sing. Persons with right-brain damage lost memory of faces and an orientation to their surroundings, even their home (referred to as spatial orientation). These early findings illustrated that speech and language functions are on the left side of the brain and facial recognition, spatial orientation, and music functions are on the right side. Both hemispheres of the brain are involved in higher **cognition** functioning, with each half of the brain specialized in **complementary** fashion.

## Hemispheric Specialization

The expression *left-brain/right-brain* refers to specialized functions of the two hemispheres. Scientific research with healthy human subjects used a new brain scan technique called positron emission tomography (PET) to confirm these findings.

Individuals were connected to a machine that mapped brain activity by lighting up to show which part of the brain was active. In a typical experiment, the researcher gave each subject a series of tasks to perform and then recorded which side of the brain was most active. Results indicated that activities involving numbers, logic, word puzzles, sequential tasks, and **analysis** were more active on the left side of the brain, whereas activities involving music, imagination, colors, or creative expression were more active in the right hemisphere. Evidence suggests that the right brain has a **global** bias, while the left brain has a **local** bias. In other words, the right hemisphere sees the picture, and the left hemisphere sees the components of the picture.

The distinctiveness of the left- and right-brain functions has led to the notion that humans have two brains. Although research shows that each hemisphere may be in charge of a specific set of functions, neither side has exclusive control of those functions. Both sides can interchange roles.

Figure 2.2.6 graphically displays a summary of those functions for both sides of the brain.

## Brain Hemisphere Learning

Research identifies the left brain as the Academic Brain because educators generally emphasize its processes in the traditional classroom, resulting in certain groups using hemisphere specialization to explain limitations of traditional learning. On the other hand, research identifies the right brain as the Artistic Brain because it is in charge of creative talents.

### Key Note Terms

**cognition** – the mental process of knowing

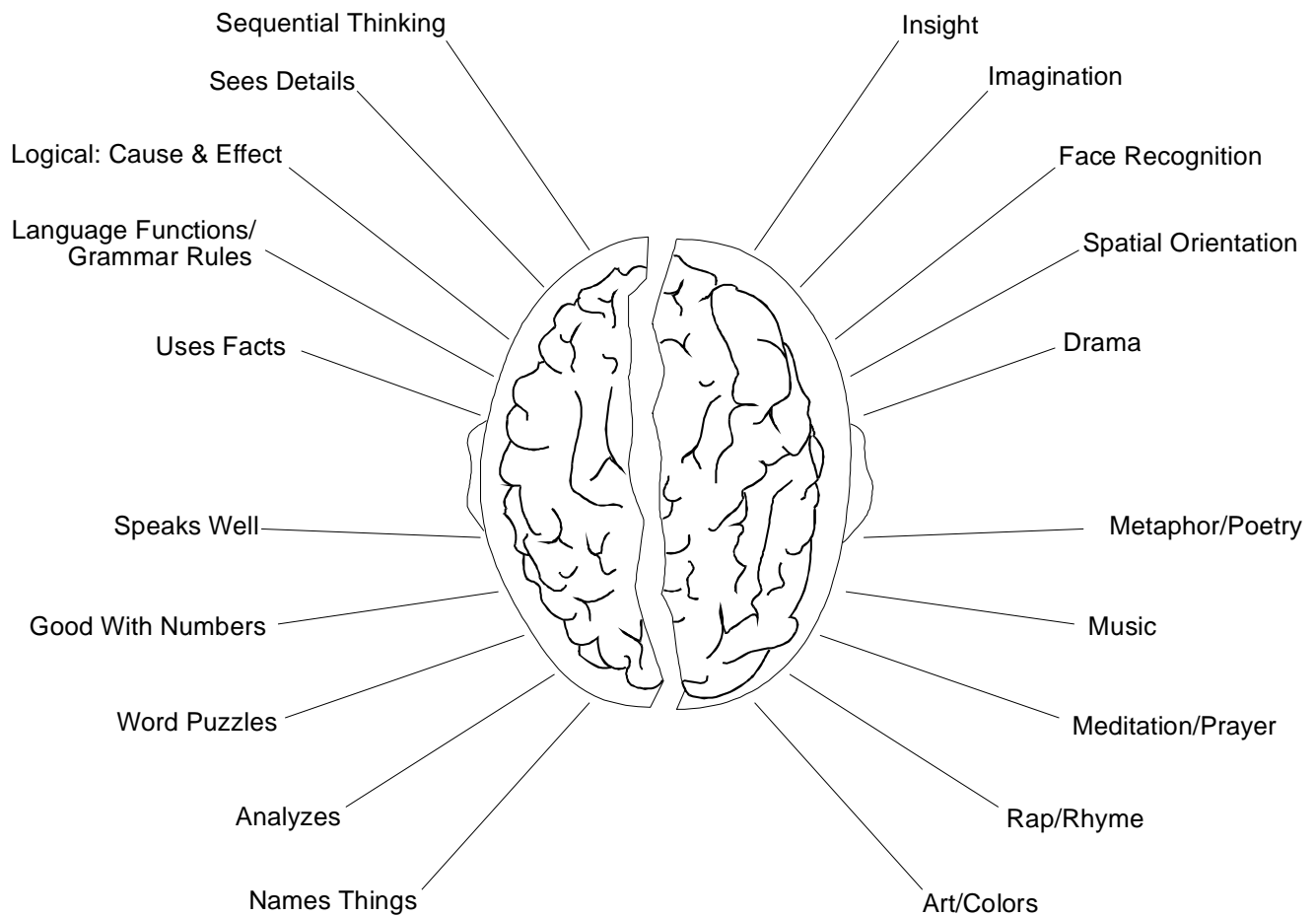
**complementary** – supplying mutual needs of offsetting mutual lacks

### Key Note Terms

**analysis** – the separation of a whole into its component parts for individual study; a study of something complex, its elements, and their relations

**global** – involving the entire earth; comprehensive, total

**local** – not extensive; confined; nearby



*Figure 2.2.6: Left-brain/right-brain functions.*

Courtesy of CACI and the U.S. Army.

Although fields such as science and medicine now pay more attention to these brain processes, education has traditionally neglected the right side, leaving half of a student's brain potential undereducated. However, more and more school systems are using whole-brain learning techniques.

Recently, educational researchers have shown that a balanced involvement of both sides of the brain in the classroom can create surprising learning gains in many types of students: children, adult learners, the so-called mentally dull, and the genius. Thus, these studies conclude that learning can proceed at astounding rates when teachers have students integrate both sides of their brain in a lesson. For example, kindergarten teachers who use music, dance, storytelling, drama, or numerous other right-brain activities as part of their routine teaching strategy not only aid the left-brain learning of their students but also aid them in learning at incredible rates. After third grade, when the use of these aids typically diminishes, learning rates drop significantly as well.

## Brain Hemispheres

The brain splits up functioning and then coordinates and **synchronizes** information processing from the two hemispheres. Split-brain research in the 1960s resulted in some early views of a logical-creative functional split. This simplistic understanding has evolved to a more complex view.

Brain scanning technology has been instrumental in furthering our knowledge base in the area of brain function, specialization, and synchronization. The brain devotes areas to **specialized** tasks. For example, there are clearly areas in the cortex devoted to visual and auditory data, as well as areas that deal specifically with language, memory, and so on.

Different, specialized brain areas process related information at the same time (such as visual data, sound, and smells). These associations enhance long-term memory storage. These initial or level-one processing areas then transfer (hence the term **bilateral transfer**) processed data into another area for higher-level thinking skills and further processing. Distinct data are then integrated.

The processing appears to take place in levels. That is, initial processing seems to focus on the sensory input. Integration occurs between areas. Higher-level thinking skills get involved to make sense of the data.

This all happens very quickly, but there is both a sequential nature and a spiraling nature to the increasingly complex processing that occurs. That is, the brain has the ability to apply increasingly sophisticated analytical and evaluative thinking and it does so progressively. The brain also **synthesizes** new information and experiences with existing knowledge, memories, beliefs, values, and emotions.

## The Dominant Side of the Brain

This lesson introduces you to the concept of brain preference, or brain hemisphere dominance, and explains brain preference from a personal, cultural, and career perspective. In class, you may have the opportunity to complete a brain preference test that will tell you which part of your brain you prefer.

As more knowledge about the brain became available, professionals in fields such as science, medicine, and education asked more questions. One interesting line of research explored the question of whether people rely on one side of the brain more than the other. Is one side of the brain **dominant**?

Researchers believe that brain dominance determines a person's preferences, problem-solving style, personality characteristics, and even career choices. For example, a right-brain individual will quickly get a feeling for a situation; a left-brain person will usually ask a lot of questions first. Table 2.2.1 reflects additional differences between left- and right-brain dominance.

There is nothing good or bad about either preference. Both orientations can be equally successful in accomplishing a single task; however, one may be more appropriate over the other depending on the situation.

### Key Note Terms

**synchronize** – to happen at the same time; coincide

**specialize** – to become adapted to a specific function.

**bilateral transfer** – the ability of the brain to transmit data processed in one hemisphere and coordinate and integrate it with data processed in other areas

**synthesis** – the combination of separate parts to form a coherent whole, as for a concentrated study of it

### Key Note Term

**dominant** – exercising the most influence or control

**Table 2.2.1: Personal Preference**

<b>Left Dominance</b>	<b>Right Dominance</b>
Classical music	Popular music
Being on time	A good time
Careful planning	To visualize the outcome
To consider alternatives	To go with the first idea
Being thoughtful	Being active
Monopoly, Scrabble, or chess	Athletics, art, or music

### **How Brain Preference Develops**

Researchers have determined that brain preference does not come from a person's conscious choice about which side of the brain to use. Researchers want to know more about if children inherit their brain preference from their parents (obtained from nature), it is socialized from early childhood experiences (obtained from nurture), or a combination of both. Different studies on how brain preference develops suggest the following:

- **Dominance is present at birth, but children may not be able to establish it well until they are five years old; other studies suggest that children continue to develop their brain preference until they reach puberty.**
- **A strong relationship exists between the brain preference of infants and their parents, suggesting that genetics has a major influence on brain preference.**
- **Early childhood experiences, or nurturing, can play a major part in brain preference development.**

### **Dominance and Career Choice**

As children grow, they will continue to prefer activity on one side of the brain, which eventually can reflect in their choice of a major in college or a career preference. College students who major in literature and the humanities show a greater degree of right-brain activity, compared to those majoring in science and engineering that show high left-brain activity.

Studies have also indicated that brain dominance can be inferred from a person's occupation. Typically, lawyers, chemists, mathematicians, and accountants are left-brain dominant because these occupations require logical, sequential, and analyti-



cal skills. Characteristically, musicians, actors, athletes, and artists are right-brain dominant because they rely on right-brain functions such as body sensing, rhythm, color imagery, and spatial orientation.

Distinctions in brain preference also exist within the same occupation. Corporate and contract lawyers are often more left-brain oriented than domestic and criminal lawyers. Rock musicians and recording artists are often more right-brain dominant than classical musicians. Successful managers and administrators in the same field may have different brain dominances. The manager who works well with people most likely has a right-brain tendency, while administrators who do a lot of planning tend to have left-brain dominance. Careers in the military follow this same pattern; some are more left-brain oriented, while others are more right-brain oriented.

## *Your Own Brain Preference*

By now you are probably very curious about your own brain preference and have definite feelings about which side you prefer. Knowing your brain preference is important because it determines certain likes, dislikes, skills, and weaknesses.

These preferences may develop very early in your life and may become more extreme as you develop and grow older. For instance, if you are good at basketball, but not at reading, you would most likely spend more time playing basketball than reading. Thus, your abilities and personality may become one-sided. To become a well-rounded, actualized person, you need to consciously develop the less preferred side of your brain.

## *Thinking Better*

In today's society, a crisis exists in how people think; that is, oftentimes people do not think independently or creatively. This lesson gives you the opportunity to examine how you think, how you can improve your thinking process and problem-solving style, and how to balance brain functions to obtain better results. Successful people know how to use their whole-brain functions to solve their problems successfully.

## *Verbal and Visual Thinking*

Each side of the brain has its own thought process, which appears in our conscious mind as voices or pictures. The left brain produces verbal thought while the right-brain creates pictures or visualizations (known as visual thought). Researchers also believe that emotional feelings, hunches, gut reactions, and so on—which people attach to these voices and pictures—represent a third brain input called kinesthetic thought. The combination of these three processes is the way people program their brains to accomplish their life goals.



### Verbal Thought

People experience verbal thought through self-talk. Psychologists use self-talk extensively today to help individuals with many of their life problems by giving them thought-stopping techniques to break the habit of negative thinking. For example, star athletes go to sport psychologists to learn how to apply positive self-talk to improve their game. Statements used to condition positive self-talk are affirmations—high-quality statements that promote successful thinking and feeling. People who make the most of affirmations like them so much that they adopt them as personal slogans. Additionally, thinking about an affirmation and repeating it over and over will make it a part of an individual's self-talk; it programs the brain to bring about the desired end result.

The following affirmations are examples that one can use to promote success in learning or for life in general:

- **Learning is something I enjoy immensely.**
- **My memory is sharp; my mind is powerful.**
- **I am kind, patient, and compassionate with myself.**
- **I have the energy and determination to tackle and solve my toughest problems.**
- **I have everything it takes to achieve my goals, beginning now.**

### Visual Thought

The visual pictures that you form in your mind may be crystal clear and in full color or they may be fuzzy, fragmented, and unstable. Some people visualize only in black and white; others do not make pictures at all. People also experience visual thought while they are daydreaming. As a child, visual thinking is prevalent, but by fourth or fifth grade, outside influences can discourage children from daydreaming. Many adults consider it to be a waste of time. However, visual thought is very important and is the beginning point of anything new in one's life. Everything created by humans once existed as a picture in somebody's mind.

The expression *a picture is worth a thousand words* means that visual pictures impress the memory better than verbal thoughts. For example, students who routinely visualize what they read in books perform better on tests and most people remember faces longer than names. Our society may give verbal thinking more importance, but it appears that visual thinking has more brainpower. The following examples are ways you can develop your visual thought power to bring about desired outcomes.

### Flashback

Flashback uses constructive daydreaming to strengthen right-brain processes. When you need more energy or motivation to get a task done, such as studying for a difficult exam, flash back to a time when you had plenty of energy and enthusiasm, for example, when you were on a hike with friends or washing cars to earn money for a trip. Get in touch with what you were experiencing in detail. Recall how you were breathing and moving. Try to match the feeling of expectancy, of

being connected to a purpose, and of getting on with things to complete them. When you come out of your flashback, bring this energy with you and apply it to the task at hand—studying for that difficult exam.

### **Flash Forward**

When you desire to accomplish a task, such as advancing in rank in JROTC, making the honor roll, or obtaining a scholarship for college, flash forward to that event. Imagine precisely how you expect to experience it. See your name on the honor roll and feel the pride swell in your chest. Feel your breath stop and your entire body warm in response to your acceptance letter. Experience how you will accept congratulations—perhaps with humility from your superiors and with unrestrained joy from your closest friends. Visit this scene in your mind often as you continue to prepare for your goals. You will be using goal-state visualization, a very powerful mental technique, to obtain what you want in life.

For best results, use verbal and visual thinking together and amplify the effect with strong feelings and emotions (kinesthetic thought). Say your affirmations aloud and see yourself acting or feeling the way they suggest. After you start your goal-state visualizations, monitor your self-talk and make sure it supports your goals. If something happens to create discouragement, talk yourself up with an appropriate affirmation, like: “There’s nothing to fear but fear itself,” or “I’ll turn down my fear and turn up my confidence.” When your verbal thoughts, mental pictures, and feelings are in harmony with your goals, you will be activating the strongest force on earth—a made-up mind.

### **Your Problem-Solving Style**

Would you like to be able to solve your problems, including those that you consider to be very difficult, with some form of a process or style? You probably already do but have never thought about it before. In the activities for this lesson, you will have the opportunity to complete an exercise that will test your problem-solving style to see if it is left brain or right brain. Both sides have advantages and limitations; however, depending on the circumstances, one of the sides or styles will provide the lead for you to make the best solution. For best results, learn how to combine the left and the right sides of your brain to solve problems, especially those very difficult ones.

## Conclusion

Knowing about the functions of the brain is good, but knowing something definite about your own brain is better. So far you know that the left- and right-brain hemispheres have specialized functions and, in many instances, educators emphasize the left brain and neglect the right brain.

During your stages of learning, growth, and personal development, the world can and will present different types of challenges that will place complex demands on your brain. Know how to use your brain efficiently. Know your individual brain preference and your problem-solving style and then use both sides of your brain to set and accomplish goals and to tackle those difficult challenges.

The following lesson covers learning style and processing preferences. Learning is a complex, interrelated system of accessing information, getting it into the brain, and processing that information to solve problems or support activities. Understanding learning styles leads to success.

## Lesson Review

1. Define the term *corpus callosum*.
2. Which side of the brain is commonly known as the Academic Brain? Which is known as the Artistic Brain?
3. Are you more left- or right-brain dominant? Explain why.
4. Explain why you feel you are more of a verbal or visual thinker.