THE HEALTHY BRAIN AND COGNITION

Information About
Cognitive Abilities and Parts of the Brain

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This is an adaptation of the handout Caring Sheet #1 from the Michigan Dementia Care Series. More information is at the end of this Handout.

The Michigan Dementia Care Series can be found on the Michigan website called Improving MI Practices at **https://www.improvingmipractices.org**

This handout identifies **parts** of the **brain** and lists a few of the many **cognitive abilities** associated with each part of the brain.

More specifics and suggestions of intervention and support strategies are in **other CAIS Handouts** and in the *Cognitive Abilities and Intervention Strategies (CAIS): Cognitive Abilities Questions to Ask* and the ***CAIS Cognitive Intervention Strategies*** by S Weaverdyck. Various parts of the brain and cognitive abilities are discussed in more detail in other CAIS Handouts (for example, **Handouts #7**, **#8, #35, #36**), the **CAIS Educational Series** and **background resources**. All these are on the above website.

INTRODUCTION

This handout outlines the organization of the **healthy brain** and its **cognitive abilities**. Cognitive abilities include a person's ability to think and to process information so this person can understand and respond to their surroundings and other people.

Each part of the brain is associated with **specific cognitive abilities**. When changes occur in a part of the brain, regardless of the reasons or causes of those changes, those specific cognitive abilities are affected. Another CAIS Handout (#7) describes the impact changes in the brain can have on a person's cognitive abilities. While CAIS Handout #7 emphasizes changes that occur in the brain and cognitive abilities of a person living with dementia, the effects on cognitive abilities apply to any changes in specific parts of any person's brain, regardless of the disorder or causes of the changes. The resulting changes in cognitive abilities can then lead to changes in behavior and a person's ability to perform tasks.

These two **CAIS Handouts (#6** and **#7**) are written as **companion pieces** with corresponding lists of cognitive abilities that can be affected by brain changes. Resources regarding intervention strategies to address these changes in cognitive abilities are noted above.

BRAIN ORGANIZATION

The brain is organized primarily into two halves called cerebral hemispheres. They are the **left hemisphere** and the **right hemisphere**. Each hemisphere is divided into four regions called lobes, three of which will be addressed here: the **frontal, temporal,** and **parietal lobes**. (The fourth lobe is called the occipital lobe and is crucial to vision. It allows a person to recognize or know what objects are, to recognize faces, and to see more than one object at a time, as well as other functions. Two additional major structures of the brain are not addressed in this handout. They are the cerebellum and the brain stem. Other important structures are buried deep within the brain.) (See Figure 1.)

The **cortex** (from the Latin word for bark of a tree) is the surface of the brain as seen in Figure 1. It looks a little like noodles stuck together. This is where the most sophisticated cognition (that is, higher intellectual thought processes) takes place. In general, the amount of surface area of the cortex correlates with the individual's quality of intellectual functioning.

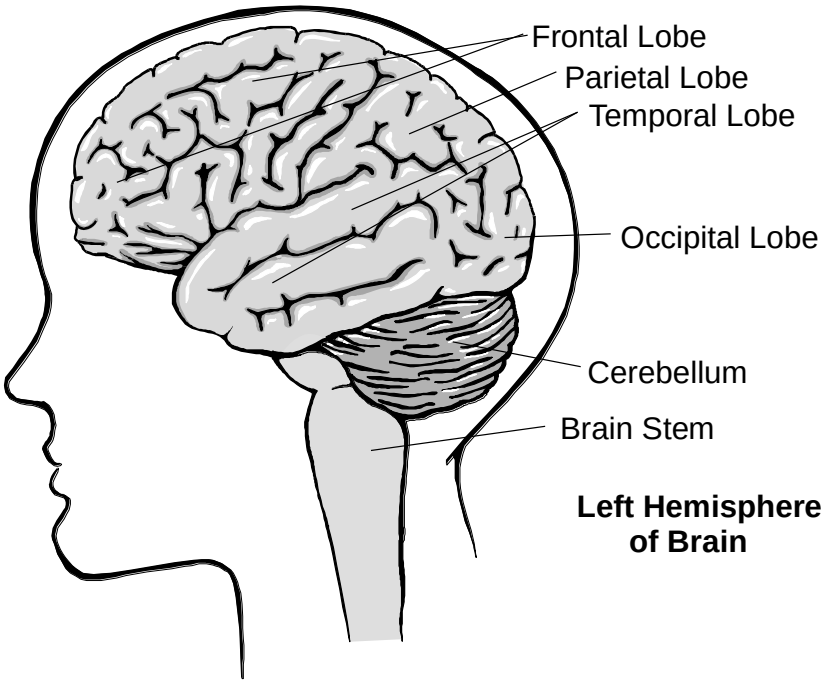

Figure 1: Schematic drawing of the brain, including the left cerebral hemisphere, cerebellum and brain stem. ***Size of the brain with respect to the outline of the head is not to scale.*** **The right side of the brain** is essentially a **mirror image of the left. The right cerebral hemisphere has the same four lobes.**

COGNITIVE ABILITIES AND PARTS OF THE BRAIN

Some of the complex cognitive abilities that are most noticeable occur in the **frontal**, **temporal**, and **parietal lobes** of the left and right cerebral hemispheres. Those are the cognitive abilities and brain structures addressed in this handout.

Each **lobe** and hemisphere is associated with and plays a major role in its **own set of cognitive abilities**. A few of the **many** cognitive abilities are listed below.

There is a complex overlap and interaction of these cognitive abilities among lobes and between hemispheres that varies from one person to the next. In addition, each lobe and hemisphere communicates with each other in complex ways, which also vary from one person to the next.

This outline of the general location of various cognitive abilities in the cortex, within each lobe and hemisphere, therefore, is **oversimplified** and **generalized**.

The organization of cognitive abilities also depends upon a person's structural dominance, as is partially evidenced by their hand dominance. Here the person described is assumed to be right handed.

(Left handed persons are usually similar to right handed persons. Some left handed persons, however may have cognitive abilities controlled by both hemispheres or more rarely by the hemisphere opposite of what is listed here.)

LEFT HEMISPHERE

1. Controls sensory and motor functions of the right side of the body.
2. Helps this person recognize and use analytical or linear thinking, including language.
3. When this person's left hemisphere changes and has difficulty functioning, the right side of the body might be weaker and altered in its ability to feel, notice, or recognize stimuli. This person may also have slurred speech or difficulty finding words they want to use.

RIGHT HEMISPHERE

1. Controls sensory and motor functions of the left side of the body.
2. Helps this person recognize and use spatial aspects of information received from their environment.
3. When this person's right hemisphere changes and has difficulty functioning, the left side of the body might be weaker and altered in its ability to feel, notice, or recognize stimuli. This person may also have difficulty locating objects in space or judging distances.

FRONTAL LOBE

The frontal lobe plays a major role in many cognitive abilities, a few of which are listed here. In general, the frontal lobe allows a person to:

1. Recognize or know what is important to focus on and to prioritize. It screens or filters stimuli for this person.
2. Plan and organize.
3. Make decisions.
4. Make use of a pool of information or ideas, by sorting through and choosing from among them.
5. Know when a task is done.
6. Get started on a task.
7. Recognize or know the order of task steps or items.
8. Stay focused on a task or thought until it is complete.
9. Recognize mistakes and correct them.
10. Know how much time has passed.
11. Recognize the chronology of events in the past and put them in temporal perspective (for example, I played as a child with my sister long before I cooked supper for my own children).
12. Recognize and monitor their own thoughts, feelings, and behavior.
13. Discern triggers or causes of thoughts, feelings, and behavior.
14. Control impulsive responses to thoughts and feelings, by censoring, delaying, or pacing their responses.
15. Adapt to new conditions or situations, or to a change in plans.
16. Interpret or explain events or a situation to themselves.
17. Tell themselves messages to help them relax, feel comfortable, and to soothe themselves.
18. Switch from one idea or action to another.
19. Imagine something not visible or tangible (that is, abstract).
20. Think about or do more than one thing at a time.

TEMPORAL LOBE

The temporal lobe, among many other cognitive abilities, allows a person to:

1. Comprehend language (left temporal lobe).
2. Express language (left temporal lobe and Broca's area in the frontal lobe nearby).

3. Remember very recent events or information (in cooperation with the hippocampus, a structure tucked behind the temporal lobe). For example, it prevents this person from repeating the same story in a single conversation or forgetting that a visitor had just been there.

PARIETAL LOBE

The parietal lobe, among many other cognitive abilities, allows a person to:

1. Notice people and objects in all parts of their visual field (that is, in the space in front of this person.)
2. Recognize spatial information. For example, it allows this person to recognize where people or objects are relative to each other and to this person's own body.
3. Organize spatial information. For example, it allows this person to draw, and to arrange dishes on the table for a meal, in a spatially correct way.
4. Write and to perform arithmetic.
5. Recognize their own body and its left/right orientation.

CONCLUSION

Other areas of the brain can play a role in these cognitive abilities, and many cognitive abilities are not listed here. These are a few of the most complex and obvious cognitive abilities. See **CAIS Handout #7** for the effects of brain changes on these cognitive abilities.

For more information

1. The Michigan website called Improving MI Practices at **https://www.improvingmipractices.org** has updates and many additional handouts and resources, including **all of these CAIS Handouts** (43 total), the Cognitive Abilities and Intervention Strategies (**CAIS**) **Questions to Ask** and the **CAIS Intervention Strategies**, **CAIS** information and background **resources**, and the **Caring Sheets**:Thoughts and Suggestions for Caring that are a part of the Michigan Dementia Care Series.
2. Mace, N., Coons, D., Weaverdyck, SE. (2005) Teaching Dementia Care: Skill and Understanding. Baltimore, Md.: Johns Hopkins University Press.

Original Sources

3. Weaverdyck, S.E. (1991) "Assessment as a Basis for Intervention" and "Intervention to Address Dementia as a Cognitive Disorder". Chapters 12 & 13 in D. Coons (Ed.) Specialized Dementia Care Units. Baltimore, Md.: Johns Hopkins University Press.
4. Weaverdyck, S.E. (1990) "Neuropsychological Assessment as a Basis for Intervention in Dementia". Chapter 3 in N. Mace (Ed.) Dementia Care: Patient, Family, and Community. Baltimore, Md.: Johns Hopkins University Press.

Dementia Care Series

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All Caring Sheets are available online at the following websites: **http://www.michigan.gov/mdhhs/0,5885,7-339-71550_2941_4868_38495_38498---,00.html** (Michigan Department of Health and Human Services MDHHS), at **http://www.lcc.edu/mhap** (Mental Health and Aging Project (MHAP) of Michigan at Lansing Community College in Lansing, Michigan), and at **https://www.improvingmipractices.org** (Michigan Improving MI Practices website)

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