

THE BRAIN AND COGNITIVE ABILITIES

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This is an adaptation of Handout One from Session One of the Cognitive Abilities and Intervention Strategies (CAIS) Educational Series.

The CAIS Educational Series of five sessions can be found on the Michigan website called Improving MI Practices at <https://www.improvingmipractices.org>

More details and specifics are available in **other CAIS Handouts** about the brain and cognition (for example, Handouts #6 and #7), and about the frontal lobe (Handout #35), and in the *Cognitive Abilities and Intervention Strategies (CAIS): Questions to Ask* and *CAIS: Intervention Strategies* by S Weaverdyck.

More information about the brain and cognitive abilities is also on the **last few pages** of this handout.

BRAIN CHANGES AND DIFFERENCES

Changes in the brain cause changes in a person's cognitive abilities.

Cognitive abilities include a person's ability to:

- Think
- Understand what they see or hear
- Figure out how to do things
- Remember
- Imagine
- Do many other cognitive functions

Most changes in the brain are the result of healthy growth, maturation, and experiences a person has. So a person's brain and cognitive abilities are unique and continually grow and change in both subtle and obvious ways.

Each part of the human brain is associated with specific cognitive abilities. When a part of the brain changes there are changes in the cognitive abilities associated with that part of the brain. These specific cognitive abilities associated with specific brain parts are **similar** in nearly **all** human **brains**. There is variation however among individual brains, in which parts work well and which parts don't work as well. Some of these **parts** of the **brain** and associated **cognitive abilities** are **listed in this handout**.

Since none of us has a perfect brain where all parts work equally well, each of us (that is **everyone**, healthy or not) has our own **unique set** or pattern of **strong** and **weak cognitive abilities** (cognitive **strengths** and **needs**) associated with strong and weak parts of our own brain.

Most of the time we are **not conscious** of our cognitive abilities, how our cognitive abilities are changing, or what our cognitive strengths and needs are. In fact, most of our thinking is not conscious at all. So most of us know very little about our own brain and cognitive abilities.

The continual growth and association of cognitive abilities with specific parts of the brain are also true for a person with an unusual brain or a diagnosis of a brain disorder. In such a case, there may be other brain changes occurring as well, that affect how well certain parts of the brain are working.

When cognitive change or difference is due to a disorder such as a stroke, traumatic brain injury, Down syndrome, or a psychiatric illness, the brain changes may be confined to certain areas and not spread to other areas in a significant way over time. The areas affected depend upon the specific disorder. Over time, cognitive abilities associated with these areas may improve, decline, or remain the same.

When the brain disorder is an irreversible **dementia** caused by specific brain changes that spread across the brain affecting many parts of the brain, many cognitive abilities become weaker over time. Dementia is a **gradual decline** in a person's ability to think, including the ability to remember and understand, due to these brain changes. The brain changes are severe and eventually affect enough cognitive abilities to make communication and tasks increasingly difficult for this person.

A person with an irreversible dementia goes through **stages** that occur as the **brain changes increase** and **spread** throughout the brain (within and outside the brain cells). Since each part of the brain is associated with specific cognitive abilities, as the brain changes spread and affect each part of the brain, the cognitive abilities associated with that part change, creating stages of change in cognitive abilities.

DEMENTIA

There are more than 100 different **disorders** that can **cause dementia**. The **most common cause** is **Alzheimer's Disease**. Other causes include:

- **Dementia with Lewy Bodies** (where there are abnormalities called Lewy Bodies within the brain cells).
- **Frontotemporal Dementia** (where the frontal and temporal lobes of the brain are especially affected).
- **Vascular** related dementia (where there are strokes or changes in blood supply to the brain).

In each disorder that causes an irreversible dementia, the parts of the brain are affected in a **different order**. So each disorder has a **different progression** of **cognitive** and **behavioral changes**, making the dementia look different in each disorder over time.

In **Alzheimer's Disease**, all the parts of the brain described below are affected. **As the brain changes spread** to each new part of the brain, creating changes in that part's cognitive abilities, the **brain changes increase** in the **parts** that have **already been affected**. So, the cognitive abilities that have already changed continue to get weaker and weaker, even as new cognitive abilities begin to change.

It is important to remember that **each person** with dementia has their own **unique** set of **cognitive strengths** and **needs at any given time**. We need to look closely to discover what those strengths and needs might be, and how they might change in ways unique to this person over time and day to day.

We should also be alert to situations or times where some of a person's cognitive abilities might **improve**, such as music or art skills or cognitive abilities that compensate for other weaker cognitive abilities. This also requires close observation to recognize subtle changes in cognitive abilities.

EMOTION AND BEHAVIOR

Brain changes cause cognitive changes, including changes in a person's ability to think, understand, remember, and respond. These cognitive changes can cause changes in this person's emotions and behavior, including distress and behavior that is distressing to others. When **distressing situations** occur, they usually **result** from **brain changes** and **cognitive changes**, not from stubbornness, manipulation, "meanness", or "ornerness".

When we try to identify and support a person's cognitive abilities, we will likely be much more effective in addressing their emotions and behavior as well. This is because we will have a better

understanding of **why** a person is feeling a certain way or engaging in a particular behavior. Trying to change a person's behavior without understanding their cognitive abilities and the reason for their distress is usually frustrating, inefficient, and emotionally challenging.

Because each person is unique with their own pattern of cognitive abilities, we have to identify in each situation the specific cognitive strengths and needs of this particular person and how they are affecting this person's emotions and behavior in this situation.

Sometimes it is **our own behavior** that **unintentionally** causes distress for a person with a pattern of cognitive strengths and needs that is different from ours, whether or not there is a cognitive disorder. Our behavior that might cause distress includes our **words, emotional tone, movements, and actions**. For example, we might talk or move too quickly. Cognitive changes or a cognitive disorder can markedly increase a person's confusion or distress in response to the behavior or distress of others.

Other triggers or causes of distress and distressing situations are listed near the end of this handout in a section called "Some triggers of momentary changes in cognitive abilities, emotions, and behavior". These are causes that we can often easily address.

We also need to remember that some interactions, tasks, or environments can unexpectedly trigger **emotional distress** for a person, especially if this person has in their remote past or recently experienced a **physical, sexual, or emotional** encounter that was **uncomfortable, painful, or traumatic**. Situations that involve, for example, removing clothing or being touched or someone else having control over this person can easily cause distress. Being in a room similar to where such encounters happened to this person can cause distress. It is important to stop an interaction or task or help this person leave the room if this is the case. Watch and listen closely to this person so you can notice how they seem to be feeling or responding to your words, movements, and actions. Moving slowly, gently, and with respect and compassion is important.

When we see behavior or a situation that needs to be improved because it indicates a person is in distress or the behavior itself is upsetting or distressing, it is most helpful to **look for why** the behavior or situation is occurring. If we assume the brain changes cause the cognitive changes which cause distress which then cause a change in behavior, then it would be most helpful to **respond** to the **distress first**. If we look closely to find the distress and **who is distressed** (whether it is the person doing a behavior or someone else who sees the behavior or feels the effects of the behavior), then we can soothe, reassure, or in some way **address the distress** of the person who is distressed (rather than simply the behavior). Once we have addressed the **feelings**, we can search for what caused the distress so we can address that distress in a more deep or permanent way. When we remove the distress the behavior will likely be reduced (since the distress causing it is gone) or will no longer be upsetting (since the distress caused by the behavior is gone).

It is always important to **ask the question "Why?"** "Why is this distress or distressing situation occurring?" "Why is this person having difficulty communicating at this moment?" "Why is this person having difficulty doing this task?" By **searching for the possible reasons or causes, we can address the reasons or causes**. We can **intervene** or develop **support strategies** that improve the situation, reduce the distress, support this person's cognitive abilities, and help this person and us feel comfortable and good about our time together.

The **most effective** way to reduce the distress in most situations is to **understand** and **support** a person's **cognitive abilities**, including their cognitive strengths and needs. We can support their cognitive abilities by **adapting** the **environment, our communication**, and the **task** itself to address the specific and unique cognitive needs and strengths of this particular person. This will help them feel more comfortable and make tasks and communication easier.

By making communication or a task easier we not only reduce distress, fatigue, confusion, and irritation, but we can help a person **conserve their energy** for more difficult or for more pleasurable tasks and experiences. A person usually works much harder to understand their environment, communicate, or do a task than you or even they realize, particularly when they have many cognitive needs. A simple task such as putting on a coat may take a great amount of energy. Even for a person who does all of these well, making communication, the environment, and the task easier for them can conserve their energy, and greatly increase their comfort and quality of life.

THE BRAIN AND COGNITIVE ABILITIES

The brain has **two halves**, one on each side called the (left and right) hemispheres that are almost mirror images of each other. Each side has **four parts** called **lobes**. For each lobe on the right side there is a similar lobe with the same name on the left side. The right side of the brain controls the left side of the body, and the left side of the brain controls the right side of the body.

Each part of the brain is associated with a set of specific cognitive abilities. When a part of the brain changes, its cognitive abilities also change. This is true regardless of what is causing the brain part to change. That is, the **same cognitive abilities** change, no matter what is causing changes to that part of the brain (healthy growth and maturation, experiences, Alzheimer's Disease, stroke, head injury, mental illness, etc).

The information in this handout applies to **all brains** in general (healthy or not) and **all types of brain disorders**. We refer to dementia, especially Alzheimer's Disease because all of the areas of the brain described here are affected and usually on both sides of the brain. In other brain disorders, only some of the areas are affected, depending on the specific brain disorder, and often on only one side of the brain. A person's cognitive abilities depend on their own unique pattern of strengths and weaknesses of various parts of their brain, and on the type of brain disorder they might be living with.

The cognitive abilities listed here for each part or lobe of the brain are only a few of the **many** cognitive abilities associated with that part or lobe.

The word "you" is used in this description of cognitive abilities and the brain to emphasize that we all experience changes in each of these cognitive abilities at various times in our lives and with varying levels of impact on our day to day functioning.

In all of the drawings of the brain below, the part labeled "Frontal Lobe" is at the **front of the brain** (behind a person's eyes and forehead). The part labeled "Occipital Lobe" is at the **back of the brain** (at the back of a person's head).

Hippocampus

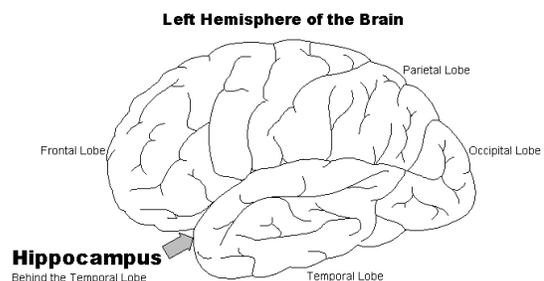
The hippocampus is a brain structure tucked up inside the brain behind the temporal lobes.

The hippocampus helps you:

- **Remember** what just happened.
For example, it lets you know what you just said, what you had for lunch, or that your friend just visited.
- **Know what to remember** and what to forget.

When your hippocampus changes you may:

- **Repeat** a question or concern or story.



- **Forget** something someone just said.
- Forget that a friend just visited.
- Be surprised and angry when someone begins to help you remove your jacket because you forgot you had agreed to remove it, or when someone begins to help you take off your clothes, because you forgot you had just agreed to take a shower.
- Remember the food someone was eating rather than what they told you.

Temporal Lobes

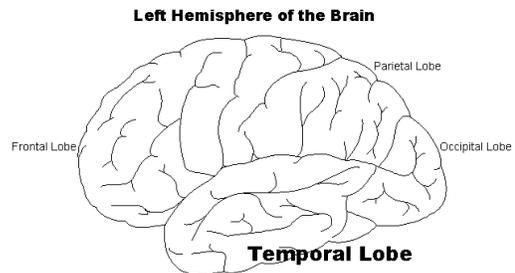
The temporal lobes are parts of the brain located on the sides of your head (above and in front of your ears).

The left temporal lobe (and Broca's area in the frontal lobe nearby) help you:

- **Understand** language.
- **Speak**.

When your left temporal lobe (and Broca's area in the frontal lobe) change you may:

- Make **nonsense** sounds when you try to speak.
- Use the **wrong words**.
- Substitute a similar word (e.g. "pip" for "pen").
- Use **fewer words** because you can't think of the words to use.
- **Say** "Yes" when you **mean** "No".
- **Not understand** what someone tells you or asks you to do.
- Use **swear words** without realizing it.
- Take **longer** to speak or to understand what someone is saying.



Parietal Lobes

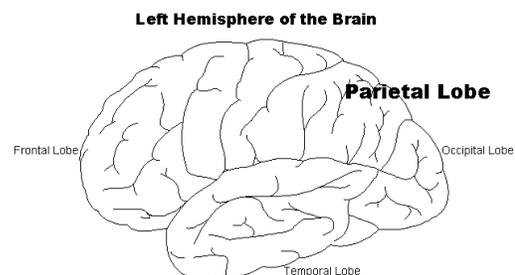
The parietal lobes are parts of the brain located above and behind the temporal lobes.

The right parietal lobe helps you:

- **Locate** and **arrange** objects in space relative to each other and to yourself.
- **Notice** everything in your visual field or space.

When your right parietal lobe changes you may:

- **Work hard** to put your hand and arm into the armhole of a shirt. (This extra amount of energy used may not be obvious to yourself or others.)
- Put a glass down on the edge of the table or of a plate, instead of beyond it, and spill what's in the glass.
- Have difficulty noticing and responding to stimuli in the **left part** of your visual field.
- Have difficulty tolerating **clutter**, many objects, and **movement** in the environment.
- Feel angry, **frustrated**, stressed, or **fatigued** from all the confusing stimuli in the environment.
- Respond better when someone **approaches** you from your right (or from the **front** if both parietal lobes are changing, as is likely the case in dementia).
- **Resist** going down the **stairs** because you aren't sure how steep the stairs are or where the edge of the stair step is.



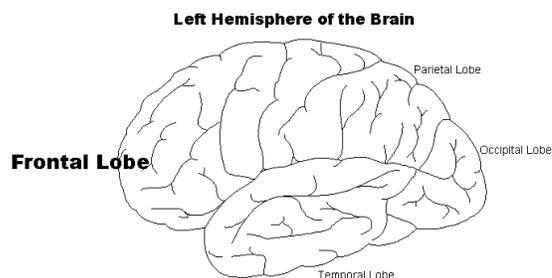
- **Resist** stepping into a tub or shower because you aren't sure how high the side of the tub or edge of the shower is, where your feet or hands should go, or how deep the water is.

Frontal Lobe

The frontal lobe is a part of the brain located at the front of the brain behind your forehead and eyes:

The frontal lobe helps you:

- Do **more than one** thing at a time (though you can focus attention on only one thing at a time)
- **Know** what to **focus** on.
- **Switch attention** from one idea or task to another.
- Sense how much **time** is passing (whether it's been twenty minutes or two hours).
- **Know** when a task is **done**.
- **Keep focused** on a task until it's done.
- **Control impulsive** responses to thoughts and desires.
- Identify the **order** of pieces of **information** or of **steps** for a task.



When your frontal lobe changes you may:

- Have difficulty focusing and staying focused on a task, object, event, or what someone is saying.
- Be **overwhelmed** when someone moves, talks, and gestures at the same time.
- Have difficulty following the **logic** of an argument.
- Need the most **important words** said **first** in a sentence.
- Need **short, simple** words and sentences.
- Refuse to do a task, such as a bath or shower because you can't think of how to do it.
- Stop a task such as a shower before you're done because you think you've been doing it for a long enough time.
- Be unable to stop from striking or grabbing someone because you have difficulty controlling impulses or switching gears quickly.

MORE ABOUT THE BRAIN AND COGNITIVE ABILITIES

Support Strategies (Interventions) Individualized to a Person and a Situation

An important concept to note about the brain is that **when a part of the brain changes**, the **cognitive abilities associated with that part change**. This can sometimes result in emotional distress and changes in behavior. When we learn how to **support, adapt, or compensate** for changes in cognitive abilities, we can **help** a person communicate and perform tasks more easily and successfully, to feel less distress, and to feel more competent and comfortable during tasks and in general. In that way distressing situations and behavior that causes distress will also decrease. Because each person is unique, we need to address each **person's own unique** pattern of **cognitive strengths and needs**.

Since changes in cognitive abilities can sometimes be subtle, it is usually helpful (but not necessary) to know which parts of this person's brain are changing, so that the cognitive abilities likely affected can be identified more easily. Supportive strategies or interventions can then be developed to address the changes in cognitive abilities that are related to the changing parts of their brain. Whether or not you know about this person's brain, **focusing on specific cognitive abilities of this particular person** in this particular situation can increase the **efficiency** of developing effective interventions or support strategies and can **avoid the trial and error** method of choosing strategies to try.

Brain Organization and the Individual

Each of the left and right hemispheres of the brain is divided into four regions called **lobes**. Three of the lobes were addressed in this handout: the **frontal**, **temporal**, and **parietal** lobes. The fourth lobe is called the occipital lobe and is important for vision. Two additional major structures of the brain (the cerebellum and brain stem) are not addressed here. These and important structures that are buried deep within the brain are often affected in dementia and are the focus of current research to better understand their effect on cognition and behavior. The **hippocampus** was also described in this handout.

The **cortex** is the surface of the brain. It looks a bit like noodles stuck together. This is where the **most sophisticated** cognition (that is, higher intellectual thought processes) takes place. In this handout, we focused on the cognitive abilities of the cortex. Only a few of the **many cognitive abilities** are listed.

Each part, lobe, and hemisphere of the brain plays a major role in its own set of cognitive abilities. These specific cognitive abilities associated with specific brain areas are **similar** in nearly **all human brains**. However, other areas of the brain also play a role in all of these abilities. There is a **complex overlap** and **interaction** of these abilities among lobes and structures and between hemispheres that can vary from one person to the next. In addition, each part and hemisphere of the brain (as well as each individual brain cell, including neurons) **communicates** with each other in complex ways, which also can vary somewhat from one person to the next. So, this outline of the general location of various cognitive abilities in the cortex within each lobe and hemisphere while accurate, is **oversimplified** and **generalized**.

In general, the complex network among various parts of the **brain** allows these parts to interact with each other and to **work together as a whole**. The brain's ability to work as a whole is important to its ability to function effectively, since many cognitive abilities depend on each other to work well. When communication among brain parts is disrupted, the efficient functioning of individual parts of the brain is likely affected.

The organization of cognitive abilities also depends upon a person's hemispheric dominance, as is partially evidenced by their hand dominance. In this handout, 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 abilities controlled by both hemispheres or more rarely by the hemisphere opposite of what is listed here.

Major changes to the left hemisphere may cause the right side of the body to be weaker and altered in its ability to feel, notice, or recognize stimuli on the right side; and major changes to the right hemisphere of the brain may cause similar effects on the left side of the body.

The **amount of change** in the brain required in each lobe to create cognitive and behavioral changes depends upon the **individual** brain, person (for example, age and general health), and circumstances.

As a person ages from birth to old age, each lobe and hemisphere becomes **increasingly specialized** in the cognitive abilities it performs. When part of the brain is not working well, the rest of the brain tries to take over the abilities associated with that part. The older the brain is, the more specialized each lobe and hemisphere has become, and the more difficult it is for other parts of the brain to take over the affected cognitive abilities.

In disorders that cause dementia such as Alzheimer's Disease, while compensation or repair may be at work, the pathological changes appear to spread more quickly than the ability of the other parts of the brain to take over the lost abilities. In less progressive disorders, such as some strokes, even brains that are quite advanced in age may recover abilities more easily than they do in dementia.

Cognitive Abilities, Emotions, and Behavior

Each person's brain (healthy or not) is different from everyone else's. Therefore, each person's cognitive abilities are different from everyone else's, especially which cognitive abilities are strong and which are weak.

A person's cognitive abilities can also vary from moment to moment and over time. This means a person's emotions and behavior can also vary moment to moment and **over time**.

We need to **watch** a person **carefully** to discern how well their cognitive abilities are working at any given moment, and therefore which intervention or support strategies will likely be the most helpful.

We must also remember to focus on cognitive abilities that are **working well** and even becoming stronger, as well as those that are weak (that is, which can be relied on and which need support, adaptation, or compensation).

Because brain functioning is often affected by outside sources, there are certain triggers that can cause momentary changes in cognitive abilities, emotions, and behavior. Such triggers can often be easily "fixed" to reduce or prevent these momentary changes.

Some triggers of momentary changes in cognitive abilities, emotions, and behavior:

- a. **Pain** with or without movement
- b. **Hypersensitivity** to touch, sound, smell, taste, and visual stimuli, such as light
- c. **Temperature** fluctuations in the air, water, and inside this person's body (possibly due to their body's reduced ability to control its own temperature)
- d. **Sensory** changes with age or otherwise (hearing, vision, touch, smell, taste)
- e. An **unmet need** or desire
- f. Feeling overwhelmed
- g. Feeling alone, frightened, worried, or anxious
- h. Feeling sad
- i. Remembering or reliving physical, emotional, or sexual discomfort, pain, or trauma from the past or that is currently occurring
- j. **Confusing cues**
- k. A need for more information or repeated information (for example, not knowing what to do next)
- l. Something in the **environment** (e.g., change, something interpreted as scary or aggressive, too much noise or visual stimulation, unfamiliar people or objects)
- m. **Stress**
- n. **Fatigue**
- o. **Hunger** (or perhaps high or low glucose levels in the blood)
- p. Needing to use the toilet or feeling discomfort in the abdomen
- q. Dehydration
- r. **Infections**, especially Urinary Tract Infections (UTIs) in older adults
- s. **Medications** (type, amount, timing, etc.)

For more information

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

Original Sources

3. 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.
4. 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.