The Brain and Cognitive Abilities

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
- Do many other cognitive functions

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), since none of us has a perfect brain. Most of the time we are not conscious of our cognitive abilities or what our cognitive strengths and needs are. In fact, most of our thinking is not conscious at all. So, most of us usually know very little about our own cognitive abilities.

This is also true of someone with an unusual brain or a diagnosis of a brain disorder.

When the brain disorder is an irreversible dementia, most cognitive abilities keep getting weaker over time.

Dementia is a gradual decline in a person's ability to think, including the ability to remember and understand, due to brain changes. The brain changes are severe enough to affect this person's ability to communicate and to perform tasks.

Each part of the brain is associated with specific cognitive abilities. As the brain changes affect each part, there are changes in the cognitive abilities associated with that part of the brain.

A person with an irreversible dementia goes through stages that occur as the brain changes increase and spread throughout the brain.

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 change.

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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.

When the cognitive change or difference is not dementia, and is due to a disorder such as a stroke, traumatic brain injury, Down syndrome, or a psychiatric illness, then the brain changes are usually more confined to certain areas. The areas affected depend upon the specific disorder.

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 a 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 "orneriness".

These cognitive changes can make a person more sensitive to the distress or the behavior of others. In fact, 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. Our behavior that might cause distress includes our words, movements, and actions. For example, we might talk or move too quickly.

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 the specific cognitive strengths and needs of each person and how they affect this person's particular emotions and behavior in each situation, as well as how they might react to our own behavior or words.

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 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.

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.

When we see a behavior or 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 might 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 primarily 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 much 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 significant 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.

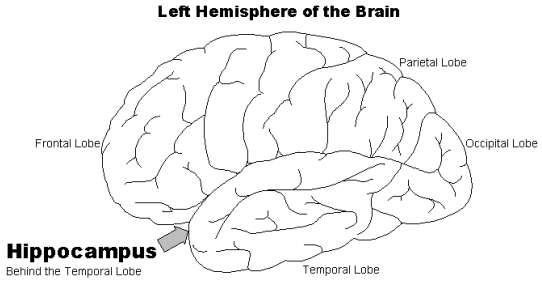
When a part of the brain is affected, the same cognitive abilities change, no matter what disorder is causing changes to that part of the brain (dementia, stroke, head injury, mental illness, etc).

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 usually all of the areas of the brain described here are affected on both sides of the brain. In other brain disorders, only some of the areas are affected, depending on the specific brain disorder. A person's cognitive abilities depend on their own unique pattern of strengths and weakness of various parts of their brain and on the type of brain disorder they might be living with.

Each part of the brain described here is associated with **many** cognitive abilities. Only a few are listed in this handout. The frontal lobe (labeled below) is at the front of the brain.

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 daughter just visited.

- Know what to remember and what to forget.

When your hippocampus changes you may:

- Repeat a question or concern.

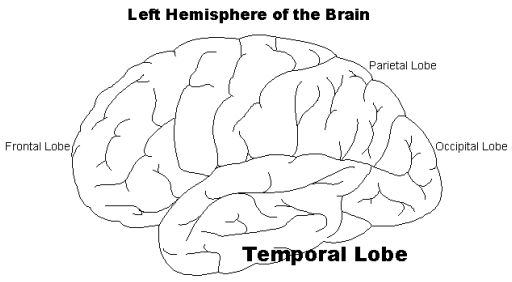
- Forget something someone just said.

- Forget that your daughter just visited.

- Be surprised and angry when someone begins to take off your clothes, because you forgot you 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.

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.

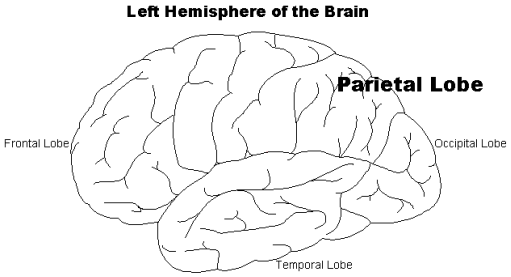
- Use the wrong words.

- 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 understand what someone is saying or to speak.

Parietal Lobes



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

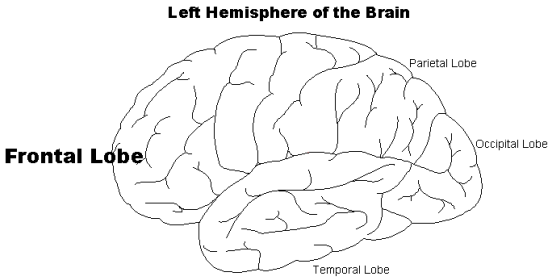
The right parietal lobe helps you:

- 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 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 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 from your right (or from the front if both parietal lobes are changing, as is likely the case in dementia).
- 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.
  - 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.
- Sense how much time is passing.
- Switch your attention from one idea or task to another.
- 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 can't control impulses or switch gears quickly.

More about the Brain and Cognitive Abilities

Caring Sheets

You can find more detail about the information in this handout on the websites cited at the end of this handout. Posted on the websites is a series of handouts called "Caring Sheets: Thoughts and Suggestions for Caring" (CS) distributed by the Michigan Department of Health and Human Services as part of their Dementia Care Series. CS #1 describes the organization of a healthy brain. CS #2 describes the effects of brain changes on specific cognitive abilities and behavior, and in particular changes to the brain and cognitive abilities in dementia. Other caring sheets suggest intervention strategies, and others describe various types of dementia in detail.

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 **adapt** or to **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 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 anything about the brain in general, or 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 little 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.

Each lobe and hemisphere plays a major role in its own set of cognitive abilities. There are **many** cognitive abilities associated with each brain lobe or structure. We listed only a few of these cognitive abilities in this handout. Other areas of the brain play a role in all of these abilities as well. There is a **complex overlap** and **interaction** of these abilities among brain lobes and structures, and between hemispheres, that varies from one person to the next. In addition, the **lobes**, areas, hemispheres, and individual brain cells (including neurons) **communicate** with

each other in complex ways allowing the brain to function efficiently as a whole. This also varies from one person to the next. When communication among brain parts is disrupted, the efficient functioning of individual parts of the brain is likely affected. So, this outline of the general location of various cognitive abilities in the cortex, within each lobe and hemisphere is **oversimplified** and **generalized**.

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 (including 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 mechanisms 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 seem to 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 always 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 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 the person's body (possibly due to the 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 or trauma from the past or that is currently occurring
j. Confusing cues
k. A need for more information or repeated information
l. Not knowing what to do next
m. Something in the environment (e.g., change, something interpreted as scary or aggressive, too much noise or visual stimulation, unfamiliar people or objects)
n. Stress
o. Fatigue
p. Hunger (or perhaps high or low glucose levels in the blood)
q. Needing to use the toilet or feeling discomfort in the abdomen
r. Dehydration
s. Infections, especially Urinary Tract Infections (UTIs) in older adults
t. Medications (type, amount, timing, etc.)

Websites for Caring Sheets

1. Improving MI Practices website: **https://www.improvingmipractices.org**
2. Michigan Department of Health and Human Services (MDHHS): **http://www.michigan.gov/mdhhs/0,5885,7-339-71550_2941_4868_38495_38498---,00.html**
3. The Michigan Mental Health and Aging Project in Lansing, Michigan: **http://www.lcc.edu/mhap**

For more information

1. Improving MI Practices Website **https://www.improvingmipractices.org** This website has this handout, updates, and many additional resources, including the Cognitive Abilities and Intervention Strategies **(CAIS)**: **Questions to Ask** and **CAIS**: **Intervention Strategies**, CAIS **Handouts** (**43 total**), the **CAIS Online Course**, the entire curriculum for these five sessions of the **CAIS Educational Series**, and other **CAIS Background Resources**, as well as the **Caring Sheets**: Thoughts and Suggestions for Caring that are 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. (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.

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