Neuroplasticity of the Brain and What It Means for Communication Deficits

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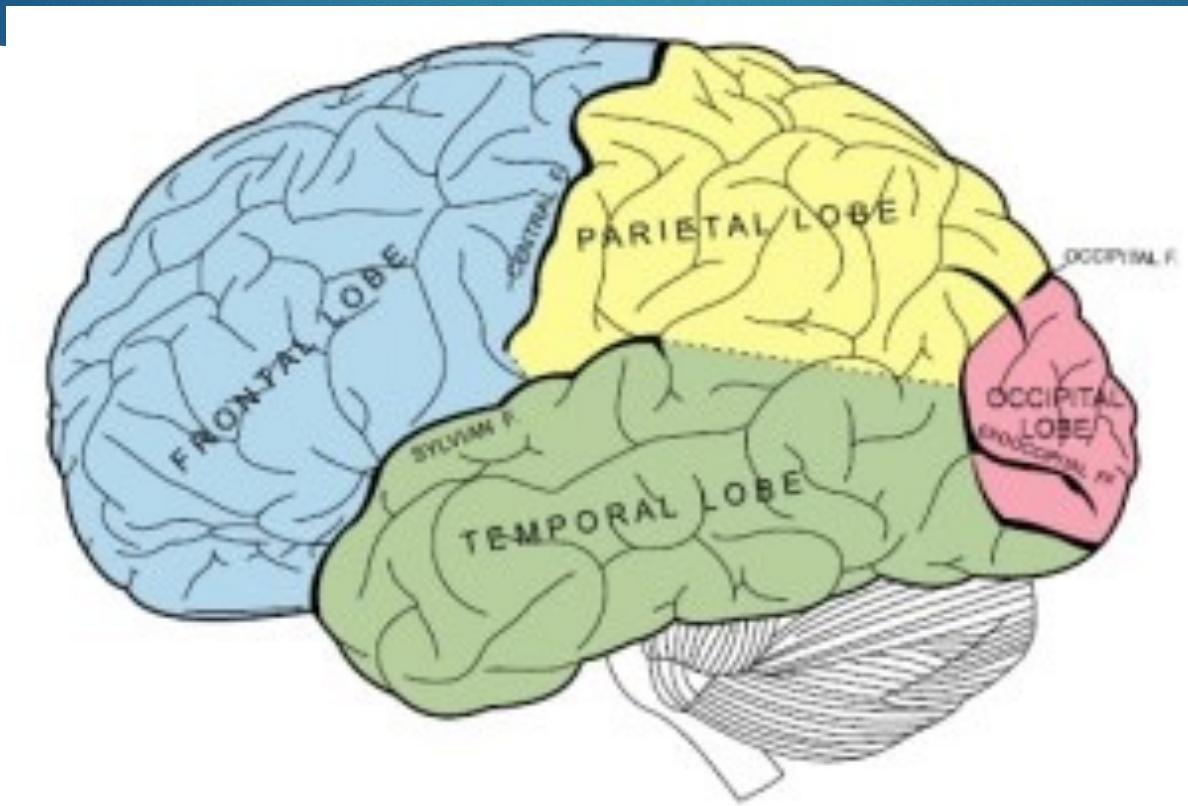
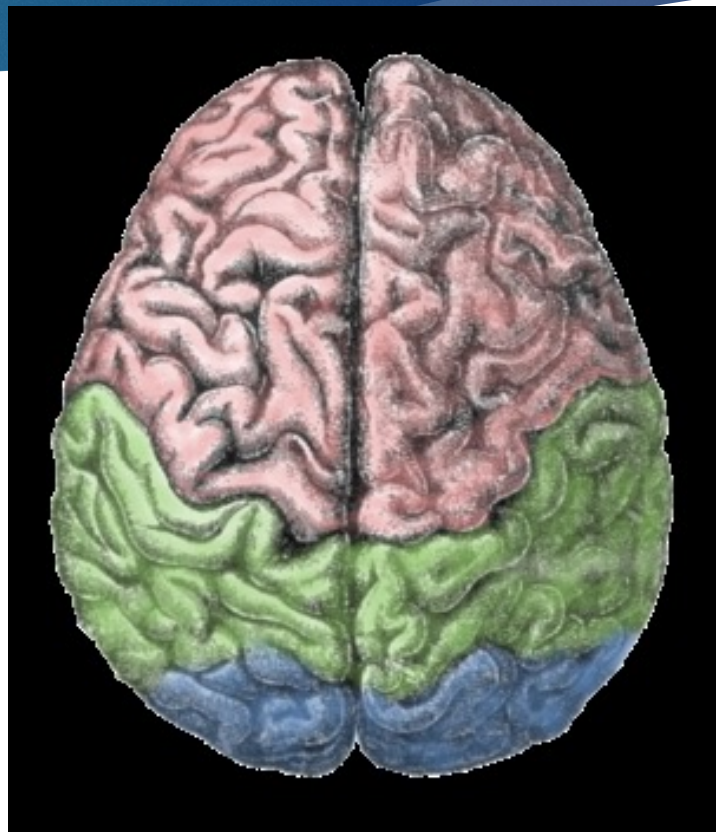
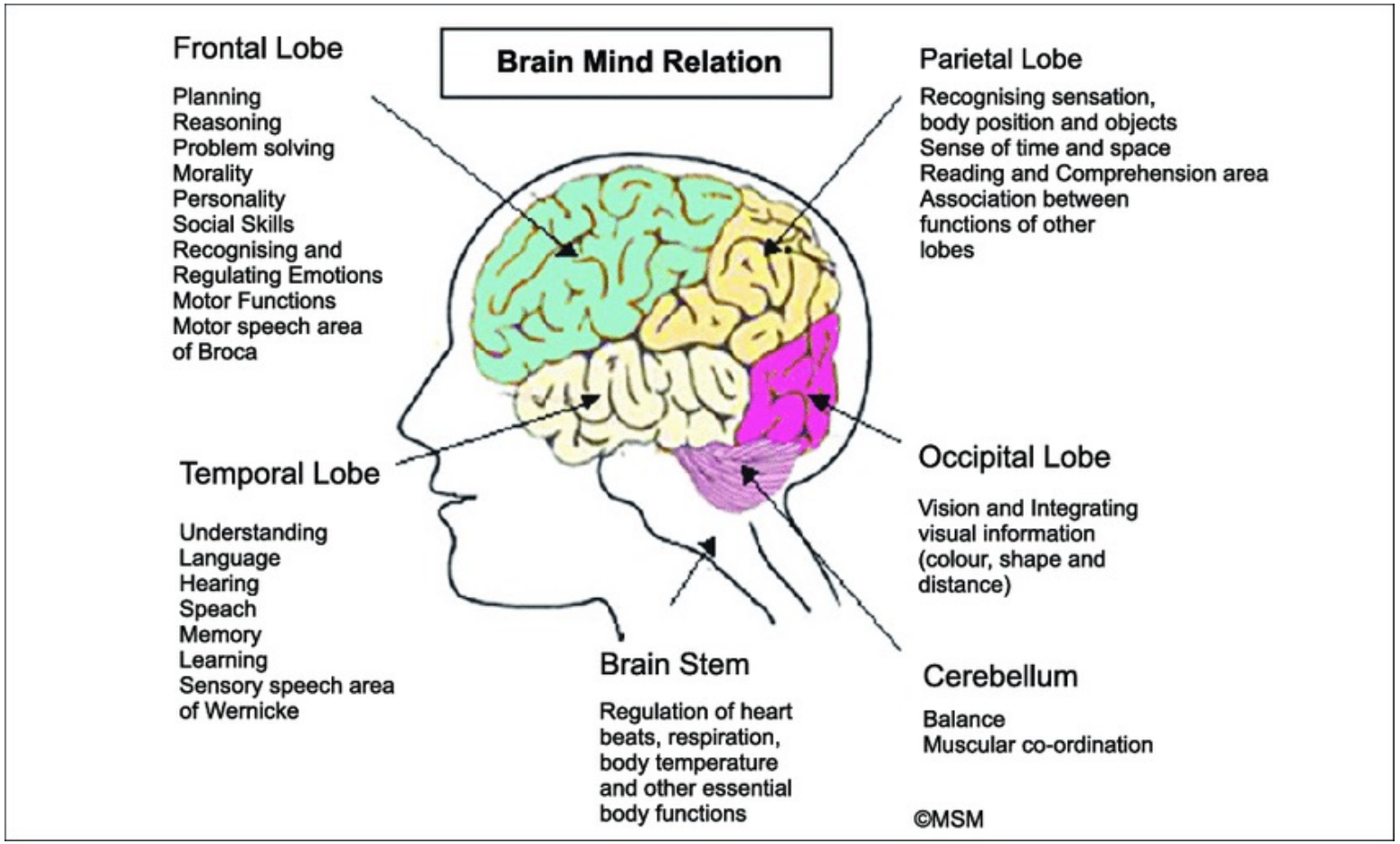
Brain Anatomy

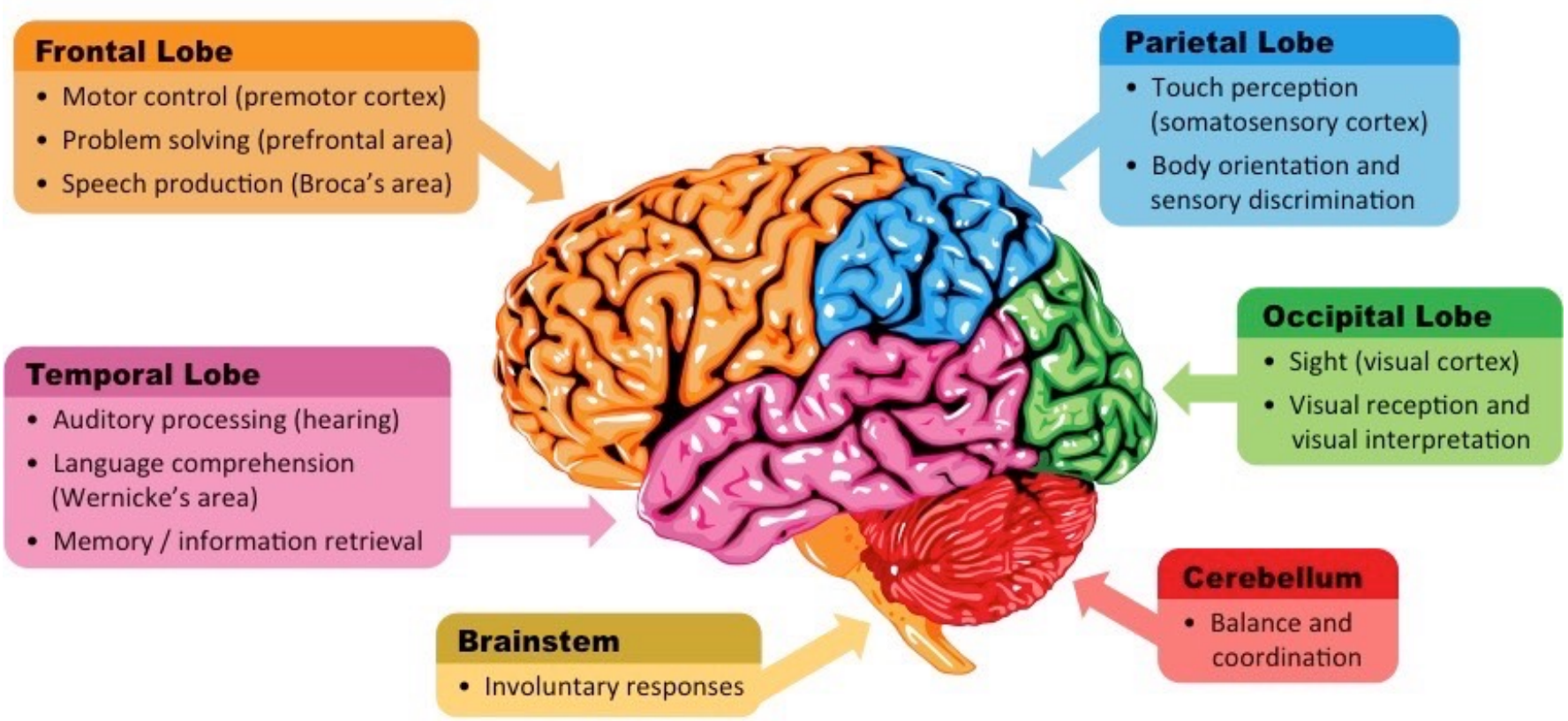




Brain Functions



Brain Functions



Common Communication Deficits

- Word finding
- Memory
- Attention
- Auditory Comprehension
- Reading Comprehension
- Writing
- Math Calculations
- Reasoning
- Problem Solving
- Dysarthria
- Apraxia
- Nonliteral language, humor
- Affect

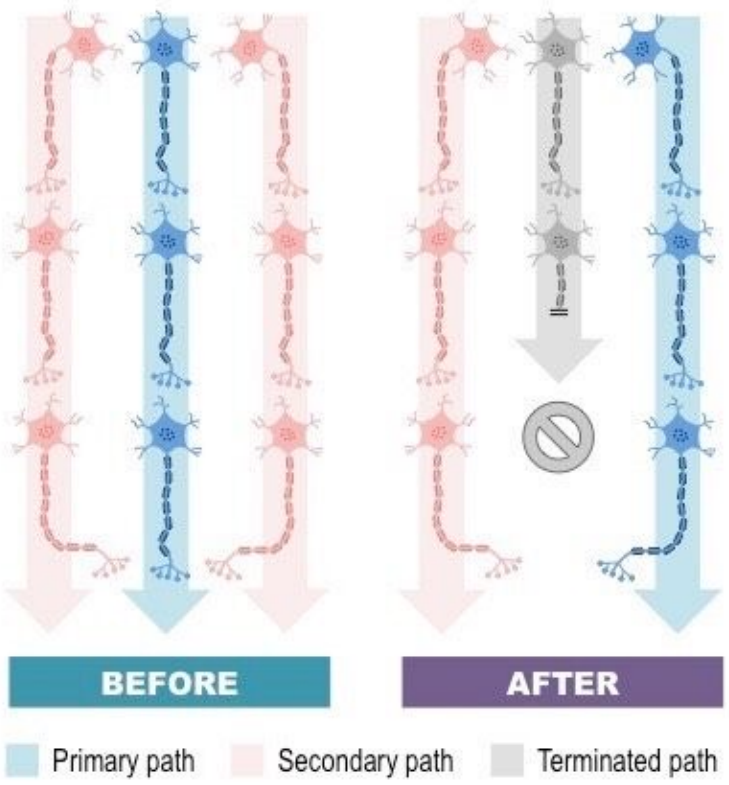
Can These Improve???

Neuroplasticity

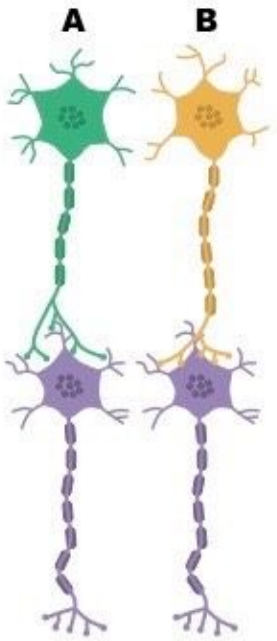
- "**The brain's ability to reorganize itself by forming new neural connections throughout life**. Neuroplasticity allows the neurons (nerve cells) in the brain to compensate for injury and disease and to adjust their activities in response to new situations or to changes in their environment"
  - https://www.medicinenet.com
  - June 3, 2021

Neuroplasticity

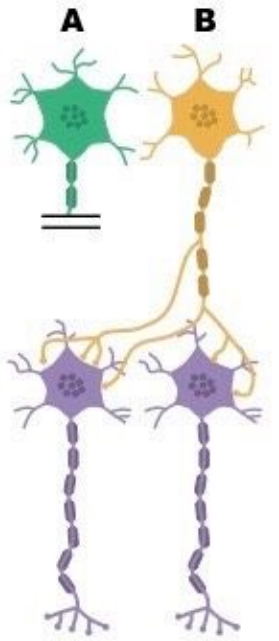
Rerouting: New connections are made between active neurons to create alternate neural pathways



Sprouting: New axon and dendrite extensions allow existing neurons to form new connections



Neural connections by neuron A and neuron B prior to degeneration



Collateral sprouting of neuron B after damage to axon of neuron A

Types of Neuroplasticity Adaptations

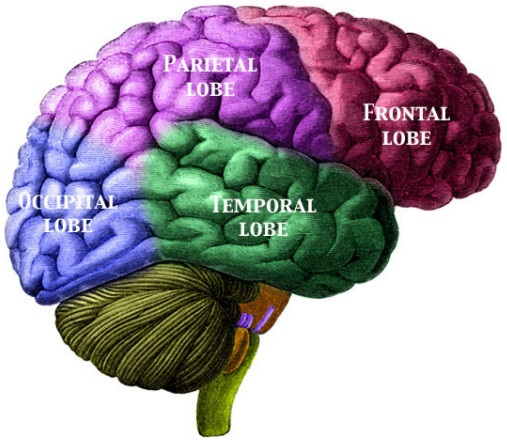
- **Neurogenesis:** Neurogenesis is the creation of new neurons in central parts of the brain, the hippocampus and olfactory bulb. Neurogenesis occurs at high rates in the young brain and can occur in the adult brain until around the tenth decade of life according to new research from Dr Maria Llorens-Martín published in Nature Medicine.
- **Synaptogenesis:** Synaptogenesis is the creation of new neural connections. Synaptogenesis occurs when the brain is exposed to new environments and experiences in activities such as traveling or learning a new musical instrument.
- **Long-term potentiation**: Long-term potentiation is the strengthening of synapses through recurring activities like studying or practicing. Long-term potentiation is associated with learning and memory.
- **Long-term depression:** Long-term depression is the weakening of synapses that aren't being used. Long-term depression is associated with memory and motor learning. Neuroplasticity research has studied long-term depression's role in memory loss from neurological disorders such as Alzheimer's Disease and drugs that impair the prefrontal cortex, such as cocaine.

https://www.emotiv.com/glossary/neuroplasticity/

Principles of Neuroplasticity

- Use It or lose It
- Use It and Improve It
- Specificity
- Repetition Matters
- Intensity Matters
- Time Matters
- Age Matters
- Salience Matters
- Transference
- Interference

Kleim& Jones, 2008



What Does This Mean for the Brain?

- Can communication deficits improve?

- Most of the time…Yes!

Circumstances When Neuroplasticity Is More Complicated…

- Progressive Diseases
  - Certain Types of Dementia
    - Alzheimer's Disease, Advanced Dementia
  - Primary Progressive Aphasia
  - Parkinson's Disease

  - Physical exercise promotes brain health (even with Dementia); may benefit neuroplasticity of the hippocampus in progressive diseases? (Kim & Sung, 2017)
  - Evidence supports that lack of or decreased plasticity is indictive of cognitive decline leading to dementia
  - Hill, Kolanowski, & Gill, 2011 suggest that while effective compensation for advancing pathology is likely limited, targeting preserved plasticity may optimize cognitive function
  - They further state, "individuals with…early-stage AD may be capable of a compensatory response to this decline that optimizes cognitive function within the confines of advancing pathology"

When Deficits Can Be Improved…

- How do we improve them??

EXERCISE!!!

Maximizing Neuroplasticity

- Daily physical and mental exercises can help increase neuroplasticity. In general, activities that help your brain fall into two categories:
- **New experiences:** Novelty establishes new neural pathways.
- **Massed practice:** The heavy repetition of a certain skill or activity strengthens neural connections.

https://www.emotiv.com/glossary/neuroplasticity/

Maximizing Neuroplasticity

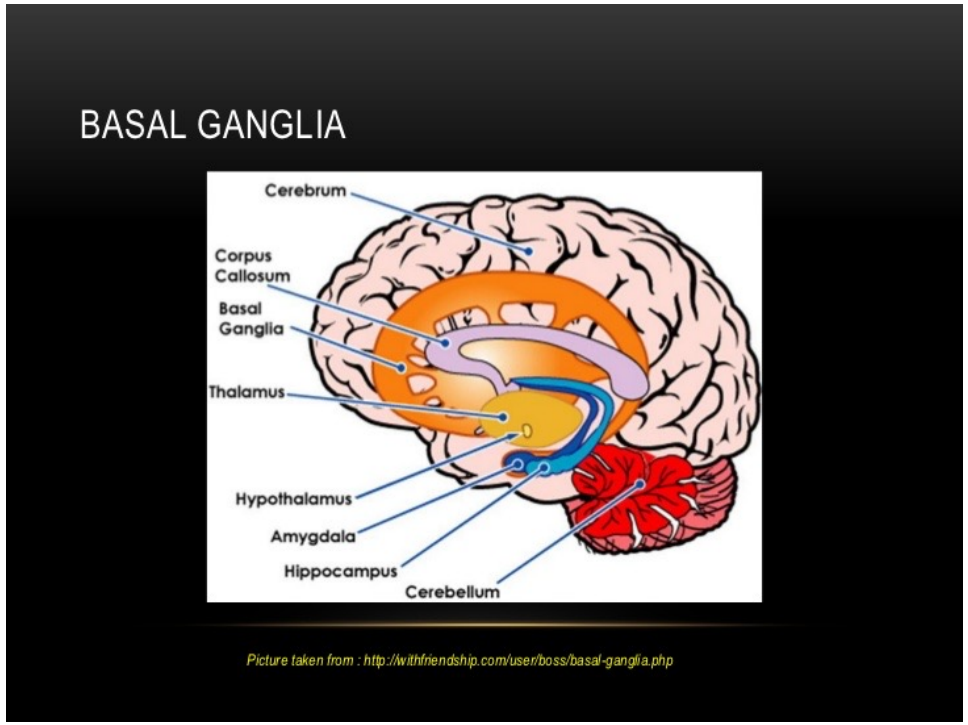
- **Non-dominant hand exercises:** Using your non-dominant hand for everyday activities like brushing your teeth or using a mouse forces the brain to form new neural connections.
- **Yoga:** Practicing yoga has been associated with decreased stress levels in the amygdala, the fear center of the brain.
- **Reading:** New concepts and new vocabulary increase and enhance brain connectivity.
- **Sleeping:** While not traditionally considered an "exercise," sleep helps with learning and memory retention by transferring information across cells and growing connections between neurons.
- **Fasting:** Intermittent fasting promotes neuron growth and adaptive responses in synapses.
- **Playing a musical instrument:** Learning a new instrument pushes your brain to form new neural networks and can increase connectivity between brain regions.
- **Brain-training games:** There are a number of brain-training or "neuroplasticity games" on the market that may help improve processing speed.

Neuroplasticity Specific to Communication

- What Can We Do to Utilize the Principles of Neuroplasticity to Improve 3 Common Types of Communication Deficits…?

Memory

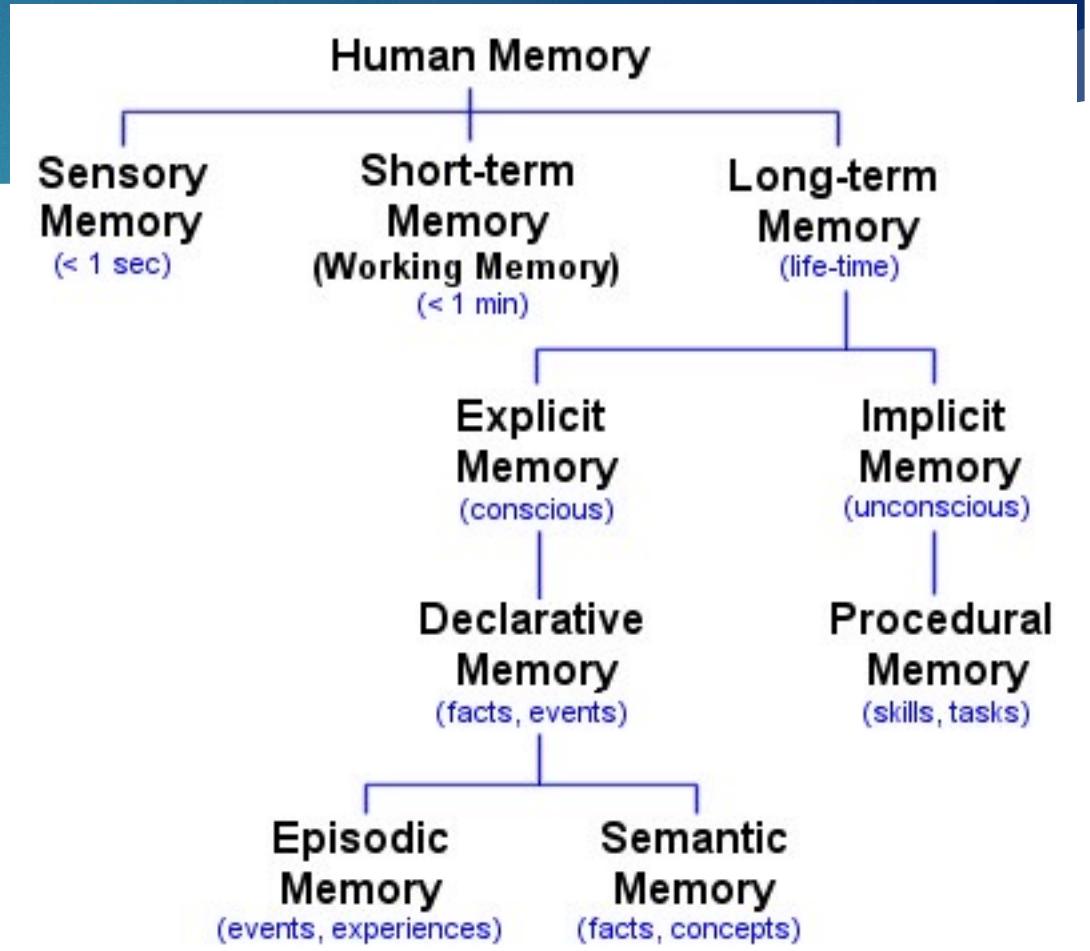
Brief Overview of Memory



3 Types of Memory

- Short Term
- Working
- Long Term

VS.



How Can I Improve My Memory?

- Memory Exercises
- Physical Exercise
- Compensatory Strategies
- Challenge Yourself!

Compensatory Strategies

- External
- Internal

External Compensatory Strategies

- Calendars/Planners
- Writing Notes
  - Sticky Note
  - Dry Erase Board
  - Notepad
- Alarms/ Timers
- Organizational Tools…Give items a home!
  - Drawers
  - Folders
  - Boxes/Trays
  - Hooks
- Environmental Aids

Internal Compensatory Strategies

- Associations
- Grouping
- Visualizing
- Verbalizing
- Observing
- Repetition

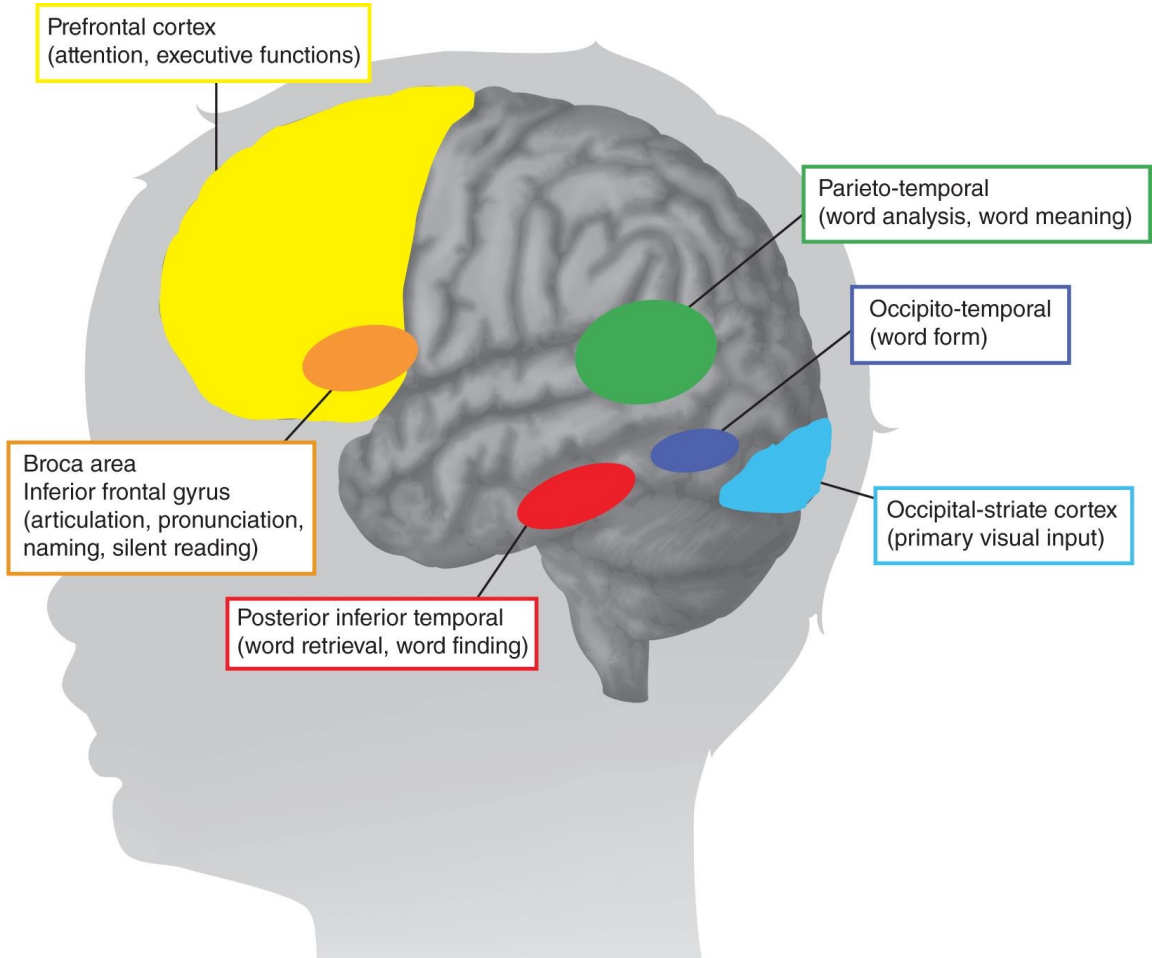
Learning Styles

- Auditory
- Visual
- Kinesthetic

- The more we use, the more likely we are to remember!

Word Retrieval

Word Finding Part of the Brain



American Academy of Ophthalmology, "Brain Systems for Reading"

Use the Word…

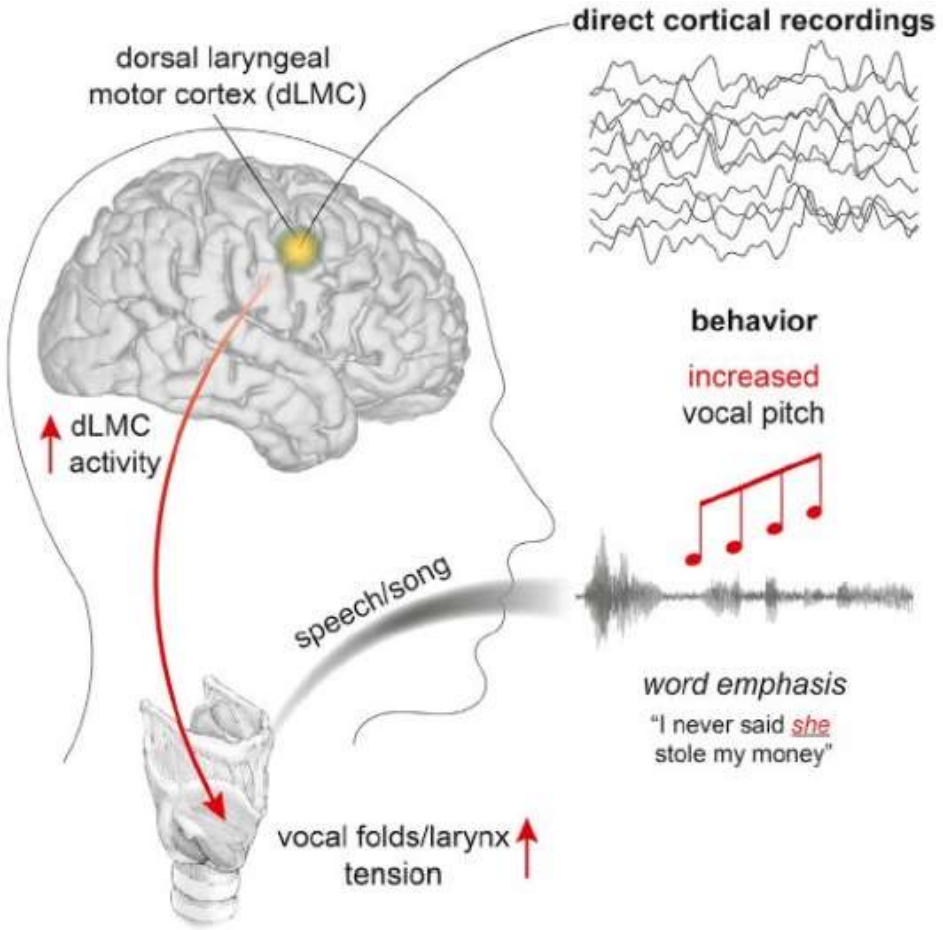
- Repetition
- Use in context
- Think about related words

Word Games/Activities

- Catch Phrase
- Taboo
- Word Fluency
  - Organizational Strategies
- Word Game Apps

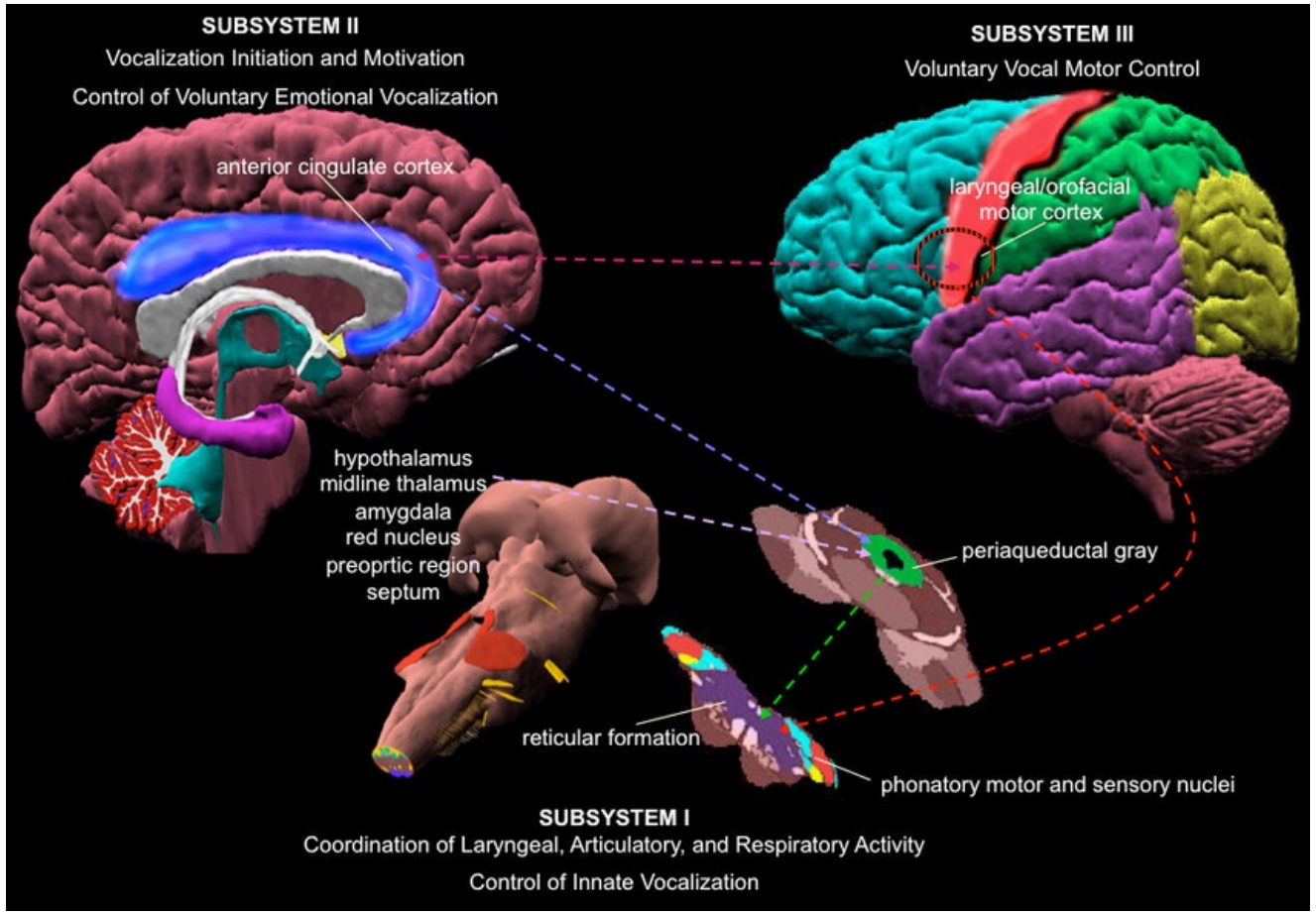
Voice and Swallowing

Part of the Brain Controlling Voice



'Music of speech' linked to brain area unique to humans, June 28, 2018; University of California, San Francisco

Part of the Brain Controlling Voice

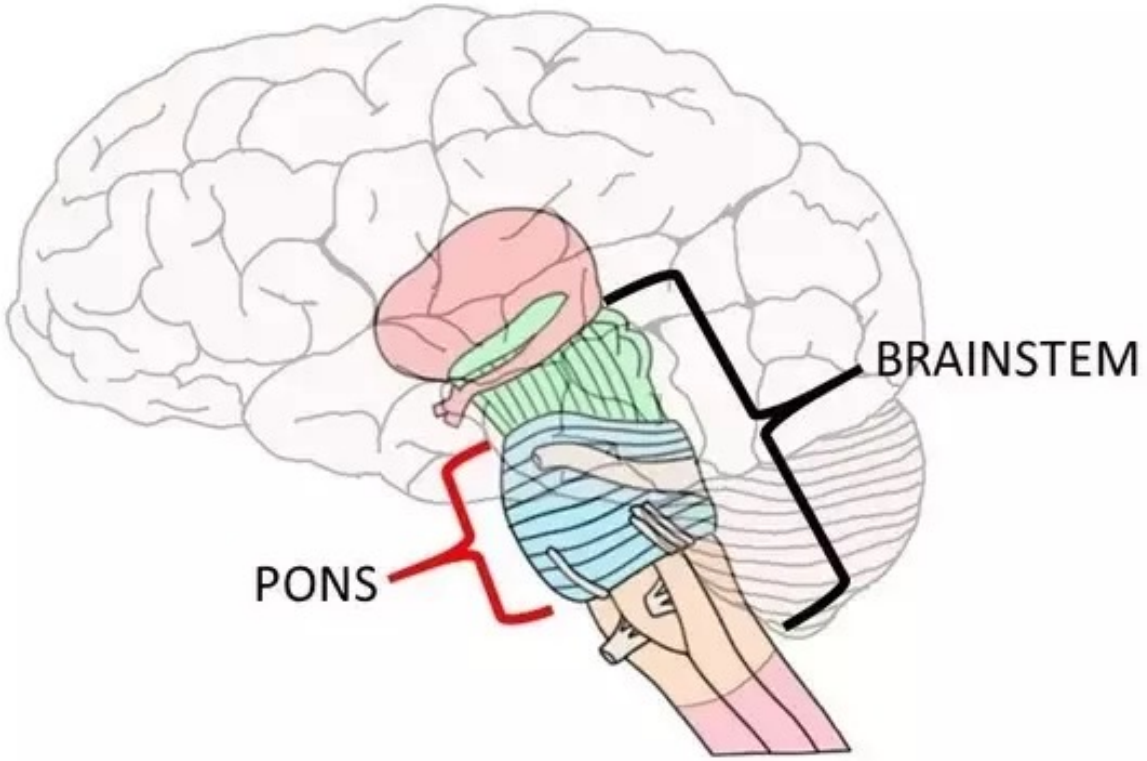


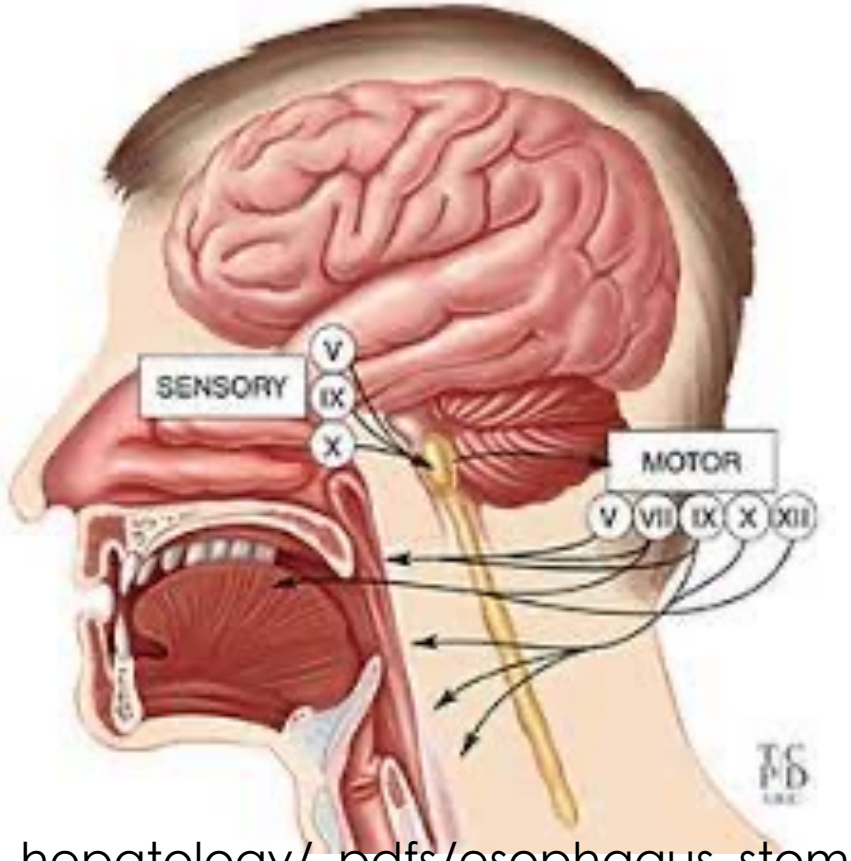
Simonyan & Horwtiz, 2011; Laryngeal Motor Cortex and Control of Speech in Humans; The Neuroscientist : a review journal bringing neurobiology, neurology and psychiatry; 17

Voice

- Volume
- Pitch
- Quality

Part of the Brain Controlling Swallowing





https://www.hopkinsmedicine.org/gastroenterology_hepatology/_pdfs/esophagus_stomach/swallowing_disorders.pdf

Swallowing

- “The best way to rehabilitate a swallow is to swallow”

Bottom Line…

- USE IT OR LOSE IT
- STAY ACTIVE
- IF IT IS SOMETHING YOU WANT TO IMPROVE, WORK ON IT

Brain Activities and Apps

- Mind Games
- Lumosity (3 free games per day without subscription
- Elevate (3 free games per day without subscription)
- 7 Little Words
- Brain Pop
- 4 Pics 1 Word
- Sudoku
- Reading
- Right Brain Left Brain
- Alphabetizing (Mentally)
- Math (Mental Math)
- Word Bubble
- Word Scapes
- 4 Words

Questions???