



**LIKE A
GOOD NEIGHBOR:
USING NEIGHBORING
NEURAL NETWORKS
TO STRENGTHEN
TARGETED NEURAL
AREAS IN VISION
TRAINING**

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WHAT IS A GOOD NEIGHBOR?

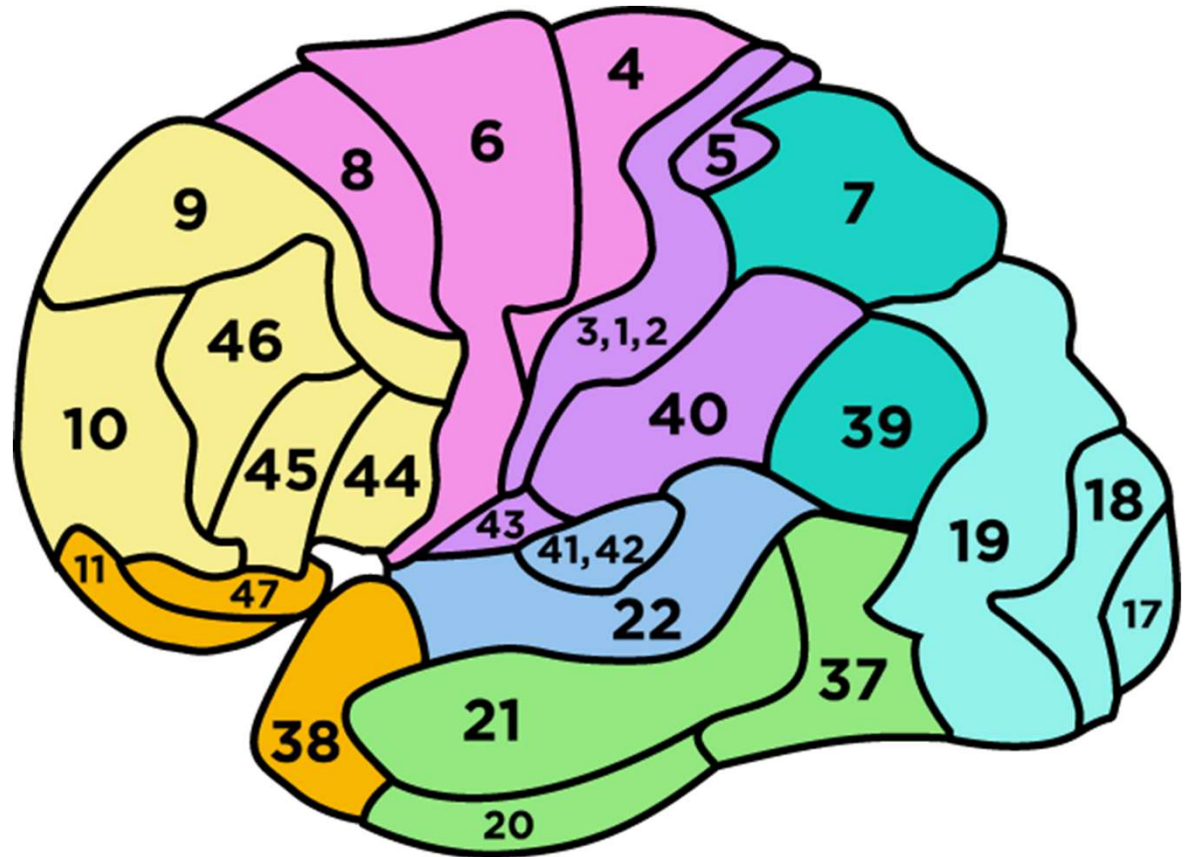
Quick Definition: One who can help someone nearby with motivation and/or resources when that someone is not able to do so alone



“GOOD NEIGHBORS” IN OUR BRAIN

Our brain is full of good neighbors
(and bad neighbors, but that is a
different discussion)

- a. 200 billion neurons
- b. Hundreds of trillions of synapses
- c. 52 Brodmann areas (that we know about) – over 80% are connected to vision
- d. Many redundancies occur in case of infection, injury or misuse.



HISTORY OF NEIGHBORING STRUCTURES INCLUDED IN THERAPY

- a. Eye movements and EMDR to improve counseling sessions
- b. Swinging in OT to improve balance, attention and behavior
- c. Reflex integration and VT (actually most of VT) - to build a foundation for movements, cognition, emotion, and behavior

Images from:

www.cuttingedgepediatrictherapy.com

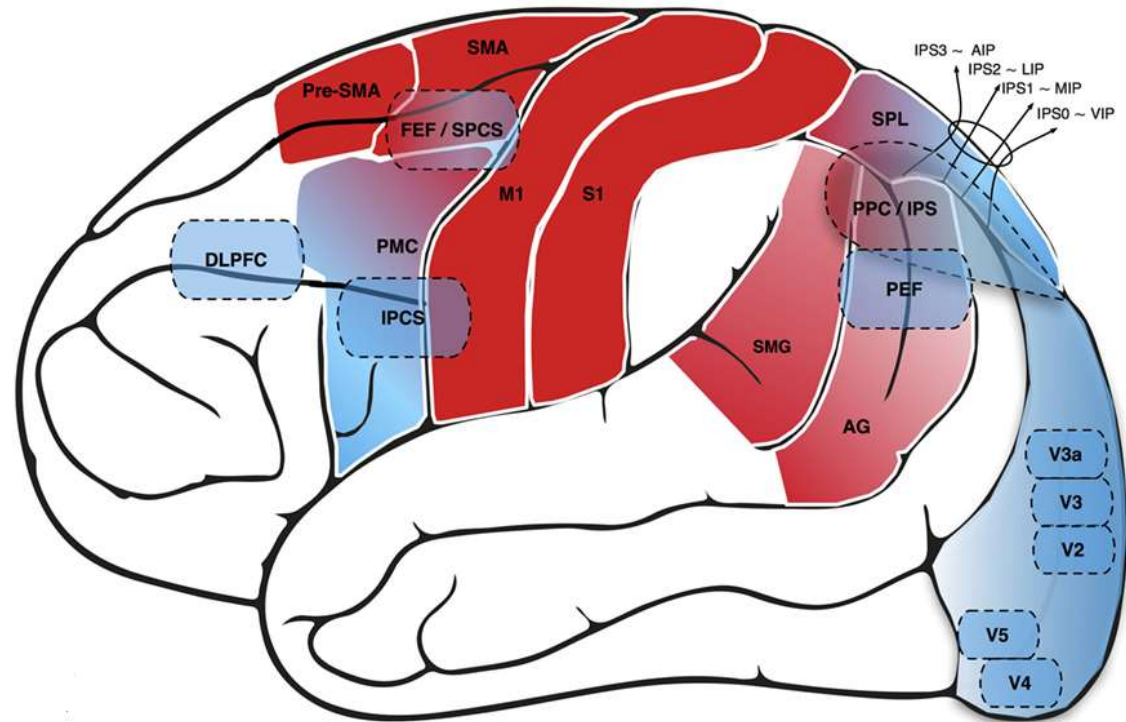
Cimarron Body Book

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FRONTAL LOBE

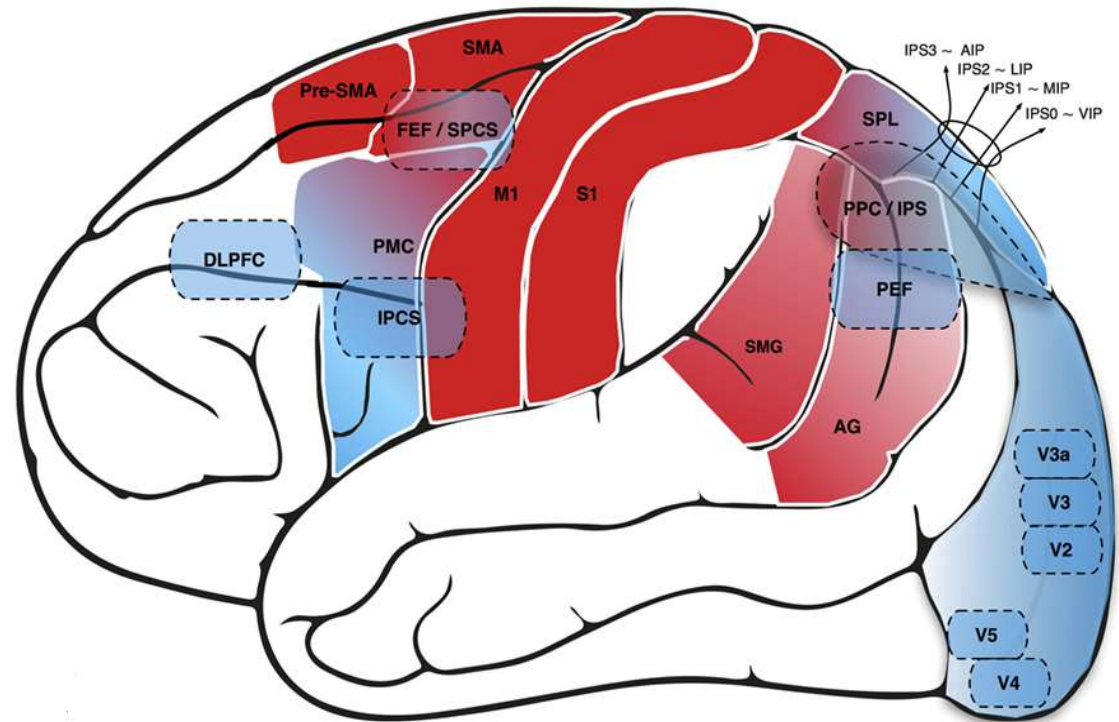
- Frontal Eye Fields (FEF) –
 - Directing visual attention
 - Intentional saccades (contralaterally)
 - Antisaccades (must coordinate with superior colliculus)
- Supplementary Eye Field / Supplementary Motor Area (SEF/SMA) –
 - Control of saccades and fixations
 - Eye-hand coordination
 - Timing and sequencing of action
 - Monitoring conflict
 - Prediction
 - Supervising behavior
 - Value-based decision making
 - Monitoring of decisions



FRONTAL LOBE (CONTINUED)

- Dorsolateral Prefrontal Cortex (DLPFC)
 - Working memory and selective attention
 - Conscious decision making
 - Reasoning
 - Working memory
 - Inhibition
 - Delayed gratification
 - Outcome prediction
 - Maintaining and shifting behavioral sets
 - Generating motor programs
 - Strategy generation
 - Using internal cues to guide behavior

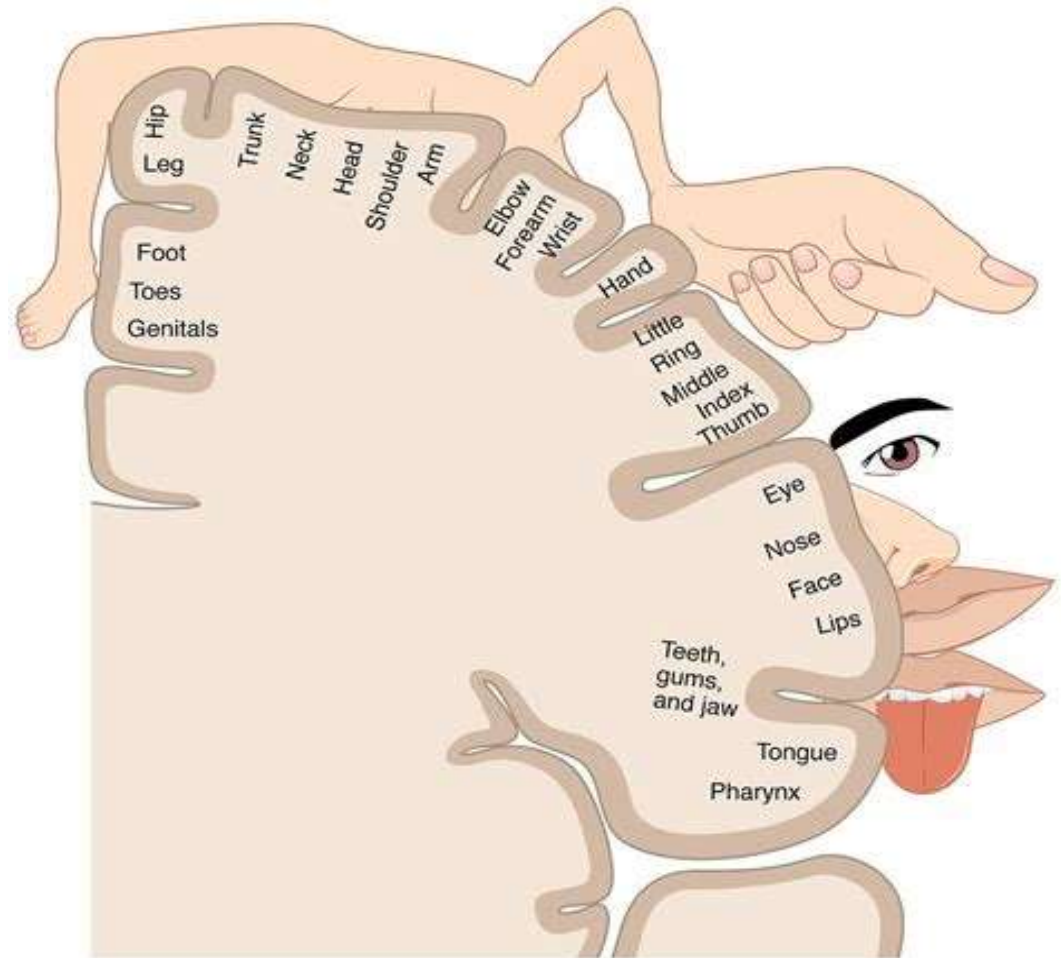
■ Image from www.frontiersin.org



FRONTAL LOBE (CONTINUED)

- Motor strip – controls muscle movement in different areas of the body
 - Areas near target brain region are most effective
 - Torso for dorsal/parietal
 - Hands and head for ventral/temporal
 - Point tongue down to the right to help eye movements down to the right

- Homunculus image from en.Wikipedia.org



PARIETAL LOBE

- i. Posterior Cingulate Cortex Gyrus (PCC) – awareness of self, pain recognition, memory retrieval
- ii. Supramarginal Gyrus (SMG)- language perception and processing
- iii. Superior Parietal Lobule (SPL)- tactile perception
- iv. Inferior Parietal Area (IPA) - visuospatial cognition
- v. Parietal Eye Fields (PEF)– reflexive saccades

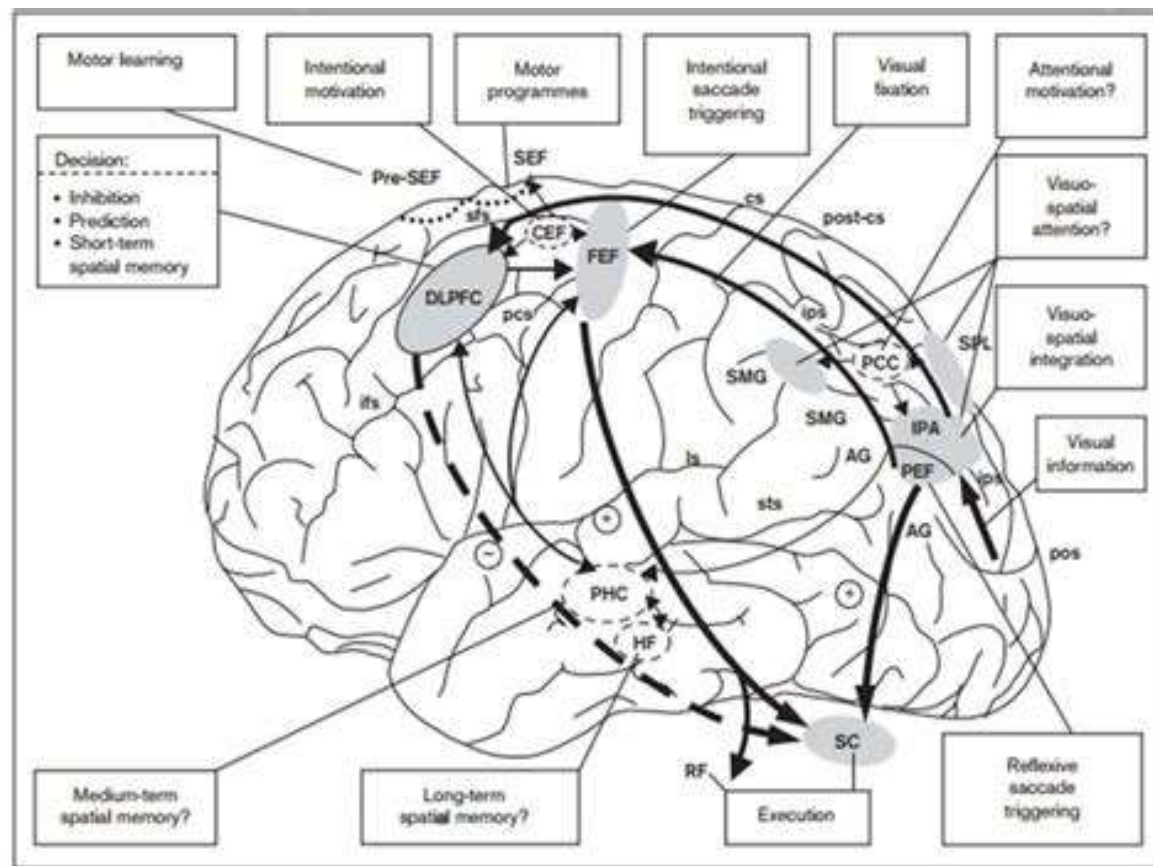


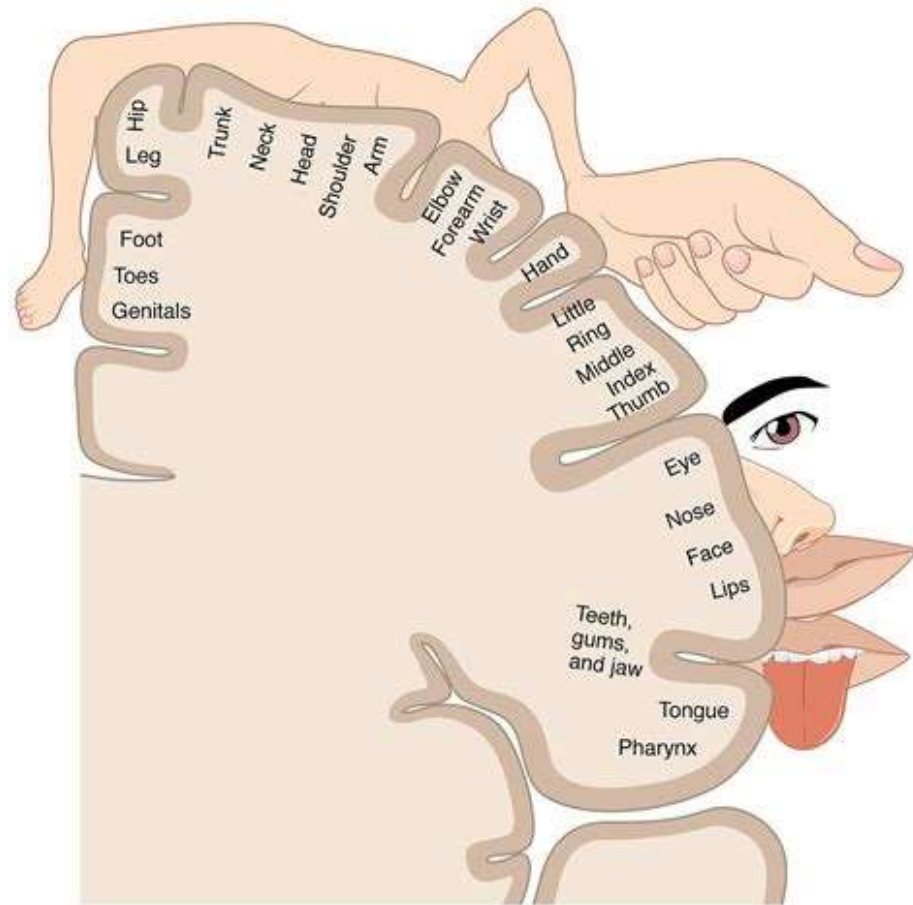
Image from www.researchgate.org

PARIETAL CORTEX (CONTINUED)

Sensory strip - receiving and sending messages of feeling from various parts of the body

- i. Areas near targeted brain region are most effective
 - i. Torso for dorsal/parietal
 - ii. Hands and head for ventral/temporal
 - iii. Stroke lower right jaw to help eyes move into lower right gaze

Homunculus image from en.Wikipedia.org

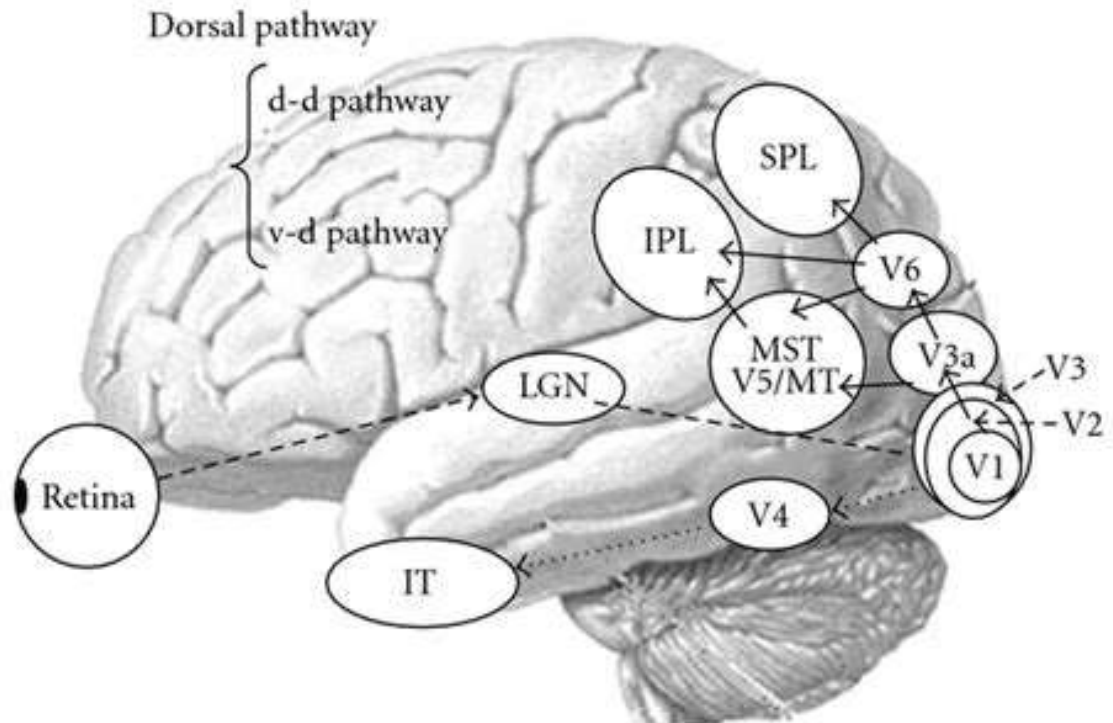
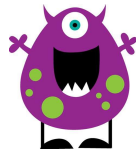


TEMPORAL LOBE

Middle Temporal (MT) – Helps pay attention to a background when something is moving through it

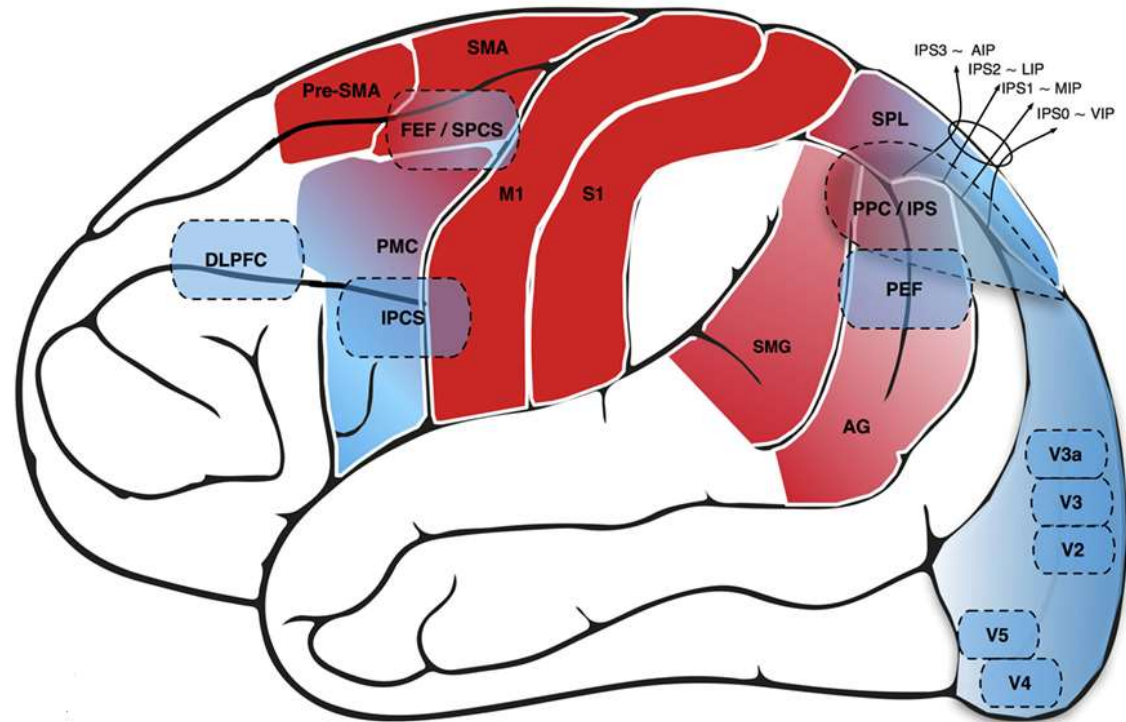


Medial Superior Temporal (MST) – Helps pay attention to a target when the background is moving (estimates target velocity so eyes can stay on target)

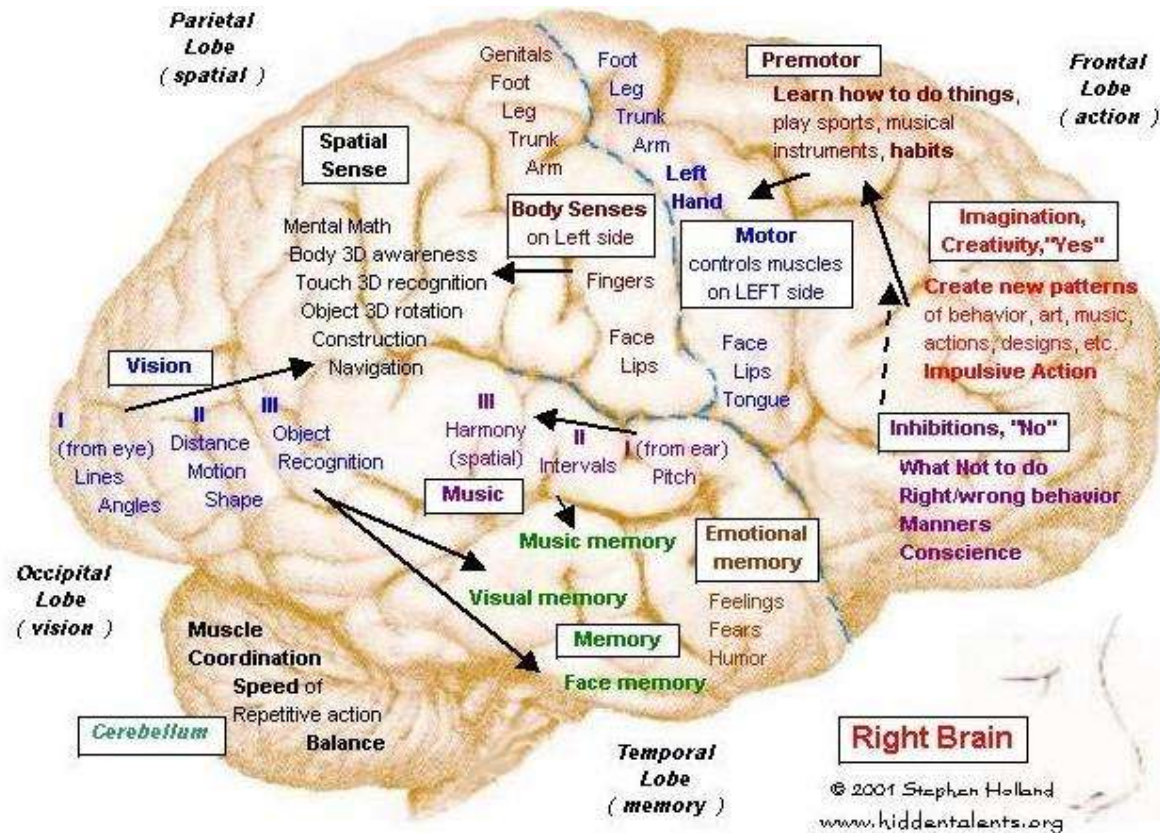


OCCIPITAL LOBE

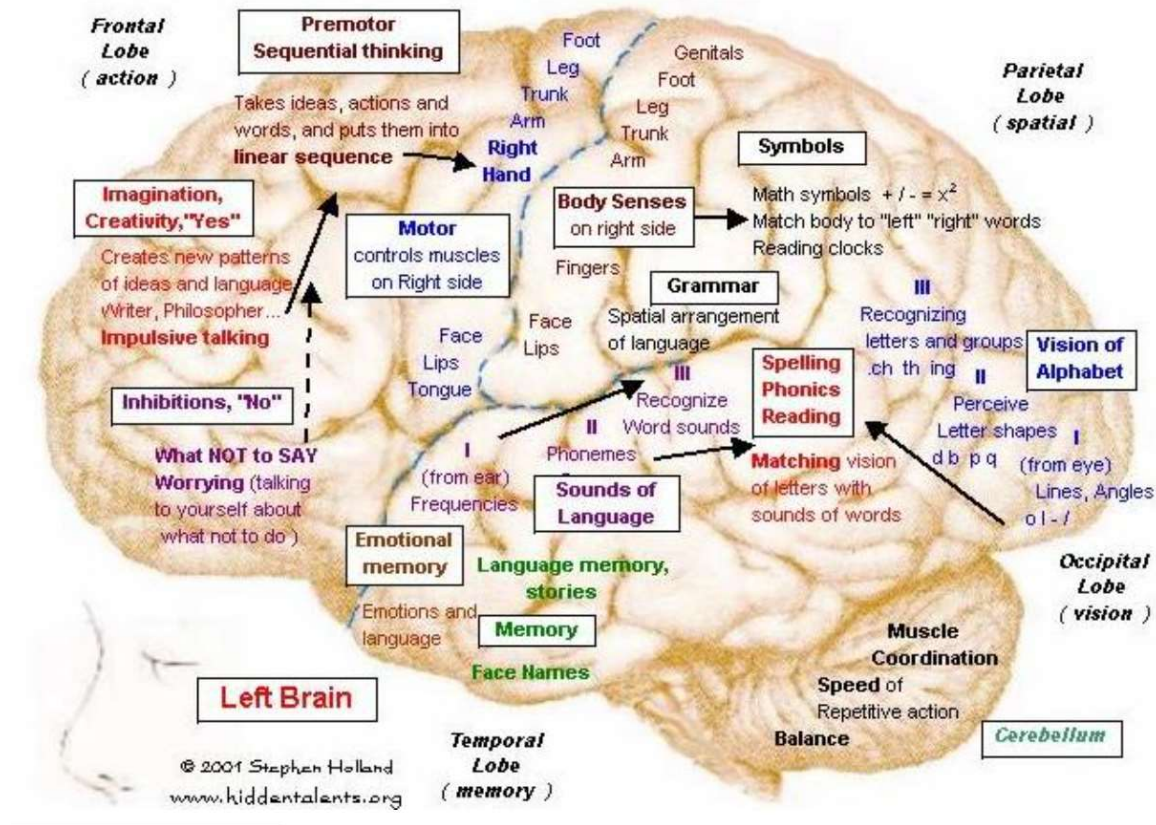
- V1: Gateway of vision, translates shape, size, movement, location of objects in the visual field
- V2: Shape, size, movement, location
- V3: Color, orientation, shape, more?
- V4:
 - Reduces visual “noise”
 - Spatial patterns
 - Color recognition
 - Object recognition
 - Assigns object labels (dog, chair)
 - Most susceptible to “crowding”



WWW.HIDDEN TalENTS.ORG RIGHT BRAIN

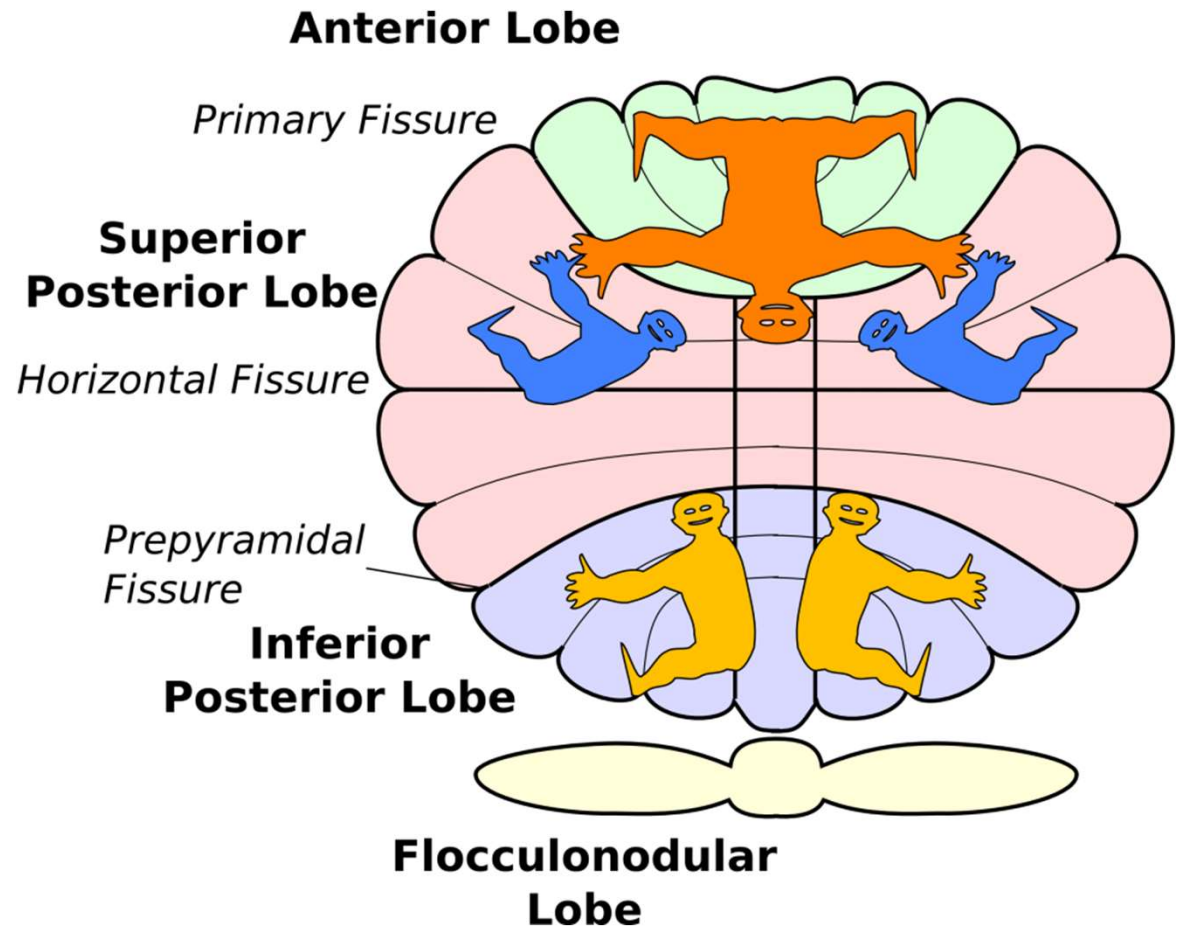


WWW.HIDDEN TalENTS.ORG LEFT BRAIN



CEREBELLUM

- **Language:** syntax, grammar, articulation
- **Vision:** construction or mental rotation of images
- **Memory:** procedural memory (like learning how to ride a bicycle), spatial memory
- **Attention:** habituation and awareness, complex functions that require attention (like math word problems)
- **Cognition:** planning, cognitive flexibility, abstract reasoning, working memory, verbal fluency, and inhibition
- **Emotions:** controlling and modulating emotions
- **Motor:** controlling and modulating movements, posture and balance

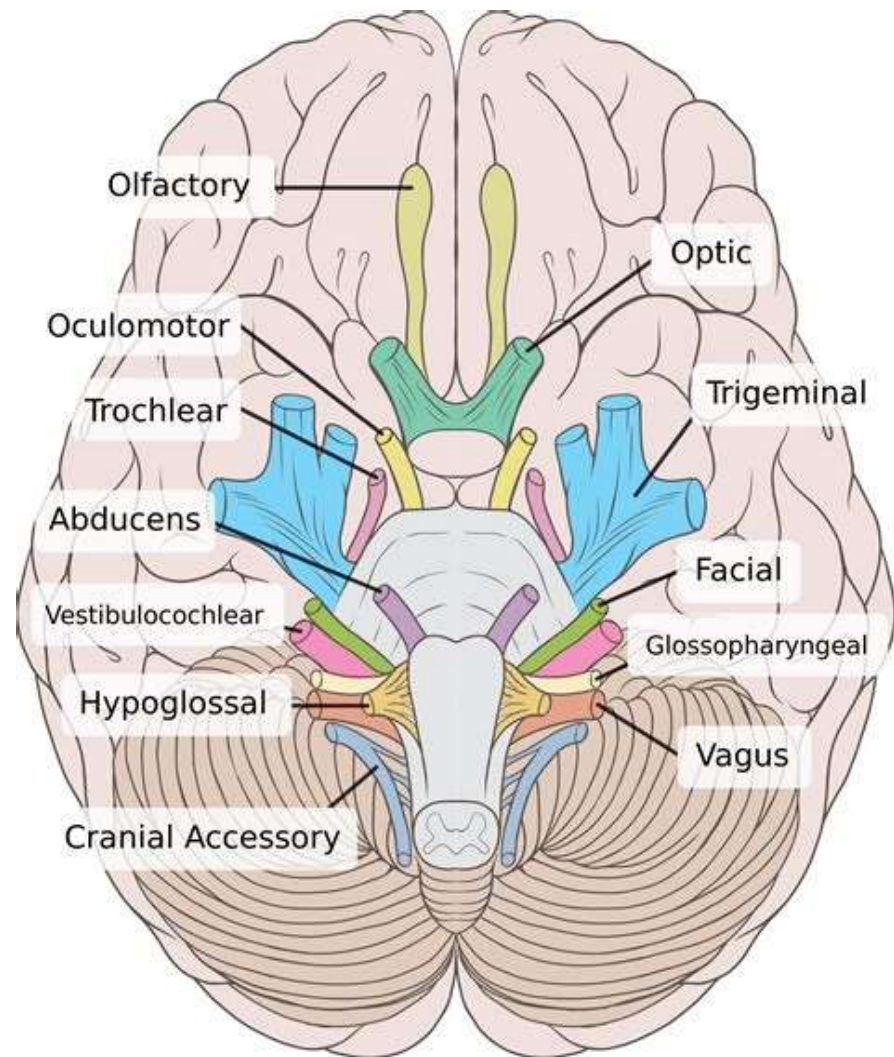


MESENCEPHALON/ DIENCEPHALON

i. Cranial nerves -

- i. Nerves on the same side tend to work as a team
- ii. Example: turning to your left to talk to a friend (eyes, ears, head, body, etc. orient/move to the left – these are all activated by right cranial nerves)

Image from en.Wikipedia.org



VISUAL FUNCTIONS OF CRANIAL NERVES

- CN1 (Olfactory Nerve): Links visual memories with smells and emotions
- CN2 (Optic Nerve): Translates light energy into electrical energy, Filters/refines early vision
- CN3 (Oculomotor Nerve): Controls eye and lid movements, Pupil function, Accommodation, Eye position information (proprioception)
- CN4 (Trochlear Nerve): Controls eye movements and position
- CN5 (Trigeminal Nerve): Sensation in eyes and adnexa
- CN6 (Abducens Nerve): Controls eye movements and position

VISUAL FUNCTIONS OF CRANIAL NERVES (CONTINUED)

- **CN7 (Facial Nerve):** Controls muscles of facial expression (squinting, blinking, closing eyes)
- **CN8 (Vestibular Nerve):**
 - Vestibular: Coordinates balance and vision through Optokinetic and Vestibulo-ocular Reflexes
 - Cochlear: Echolocation (yoked to eye movements)
- **CN9 (Glossopharyngeal Nerve):** innervates tympanic membrane (modulates sound, matches sound with vision)
- **CN10 (Vagus Nerve):** can decrease visual functions of accommodation, convergence, pupil miosis, peripheral awareness, sensitivity to light and motion)
- **CN11 (Accessory Nerve):** connects neck to vision through cervico-ocular reflex
- **CN12 (Hypoglossus Nerve):** connects tongue to eye movements through homologous columns

TEAM PROJECT

- Volunteers needed:
 - I will send you a list of functions, you will send me a list of vision therapy activities that use that function
 - I will gather everyone's information and organize it
 - I will send you the end result
 - Email: thomasamy@live.com

