



THE TURN TO THE BRAIN





COGNITIVE SYSTEM AS FUNCTIONAL SYSTEMS



FUNCTIONAL SYSTEMS

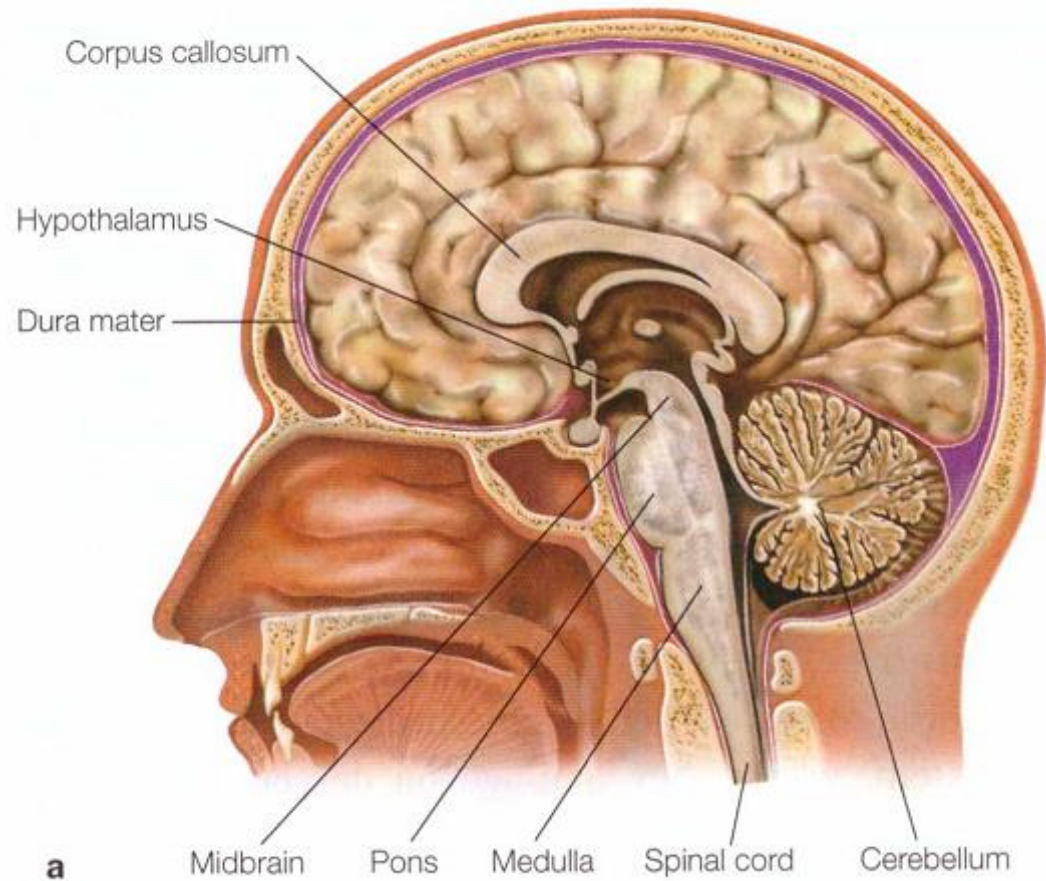
- Functional systems only concern about what they do and how they do it.
- Do not care about the particular physical structure implementing that function.
- So, functional systems are ***multiply realizable***.
- Therefore, brain was not of much interests to cognitive scientists



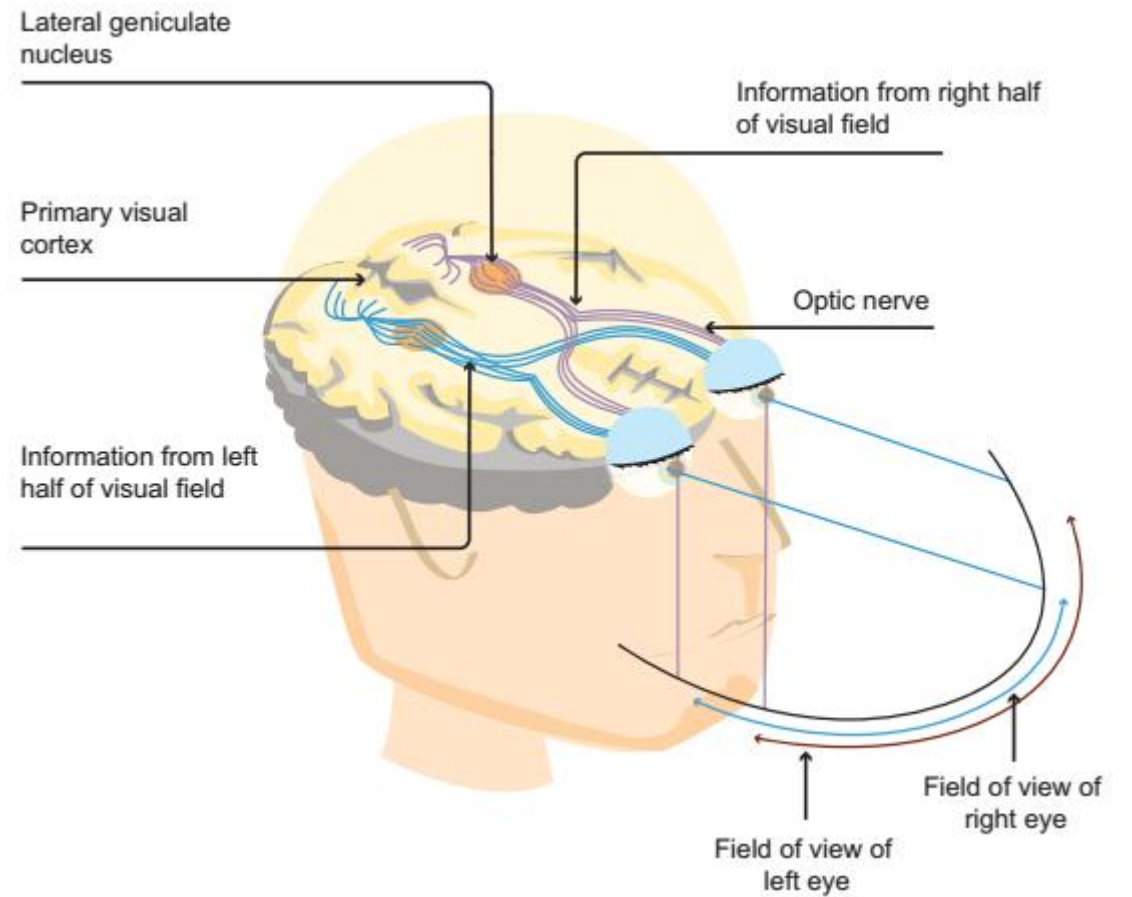
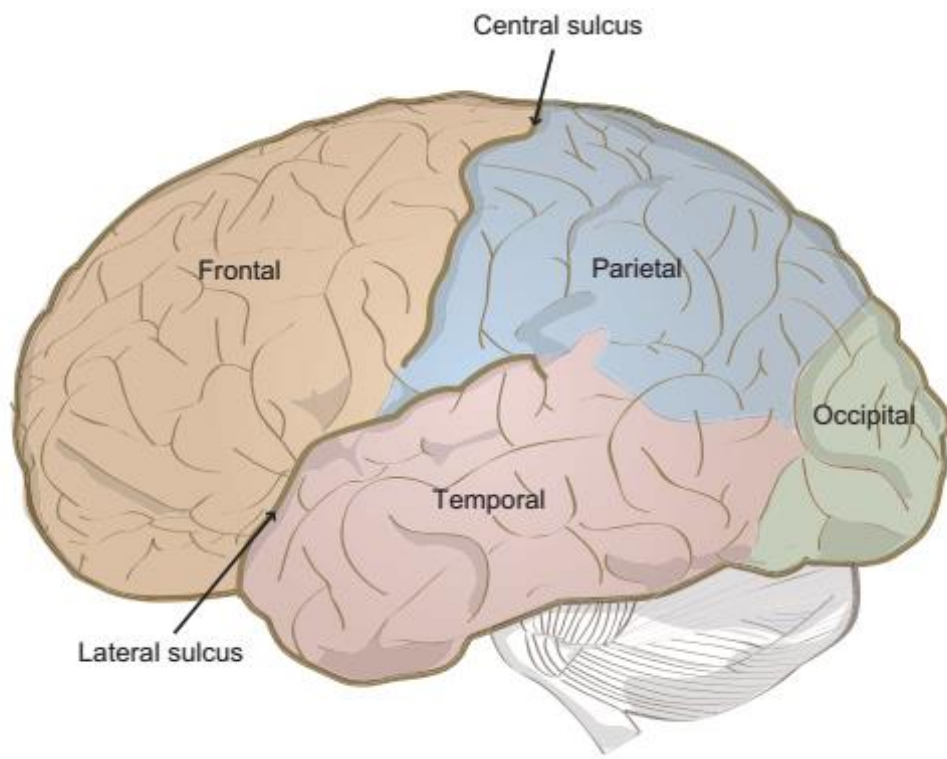
THE ANATOMY OF THE BRAIN AND THE PRIMARY VISUAL PATHWAY

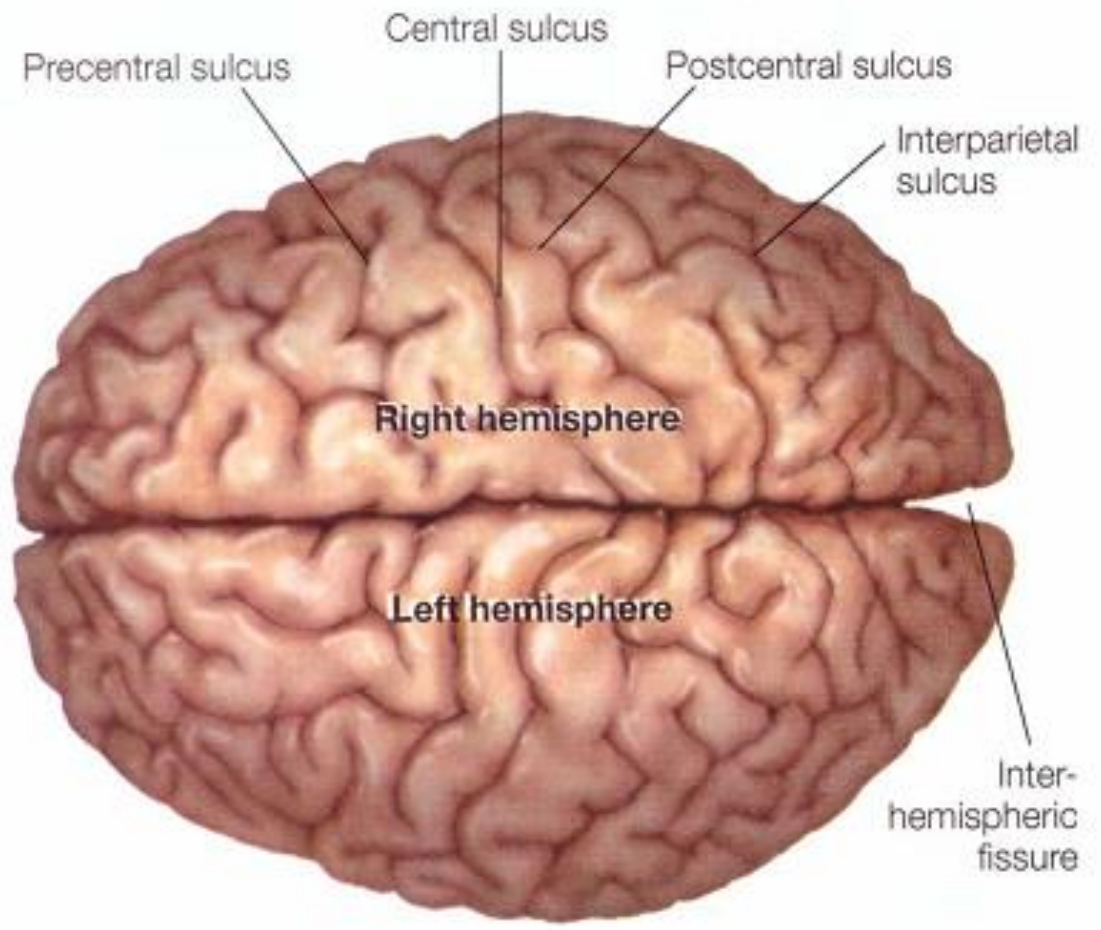
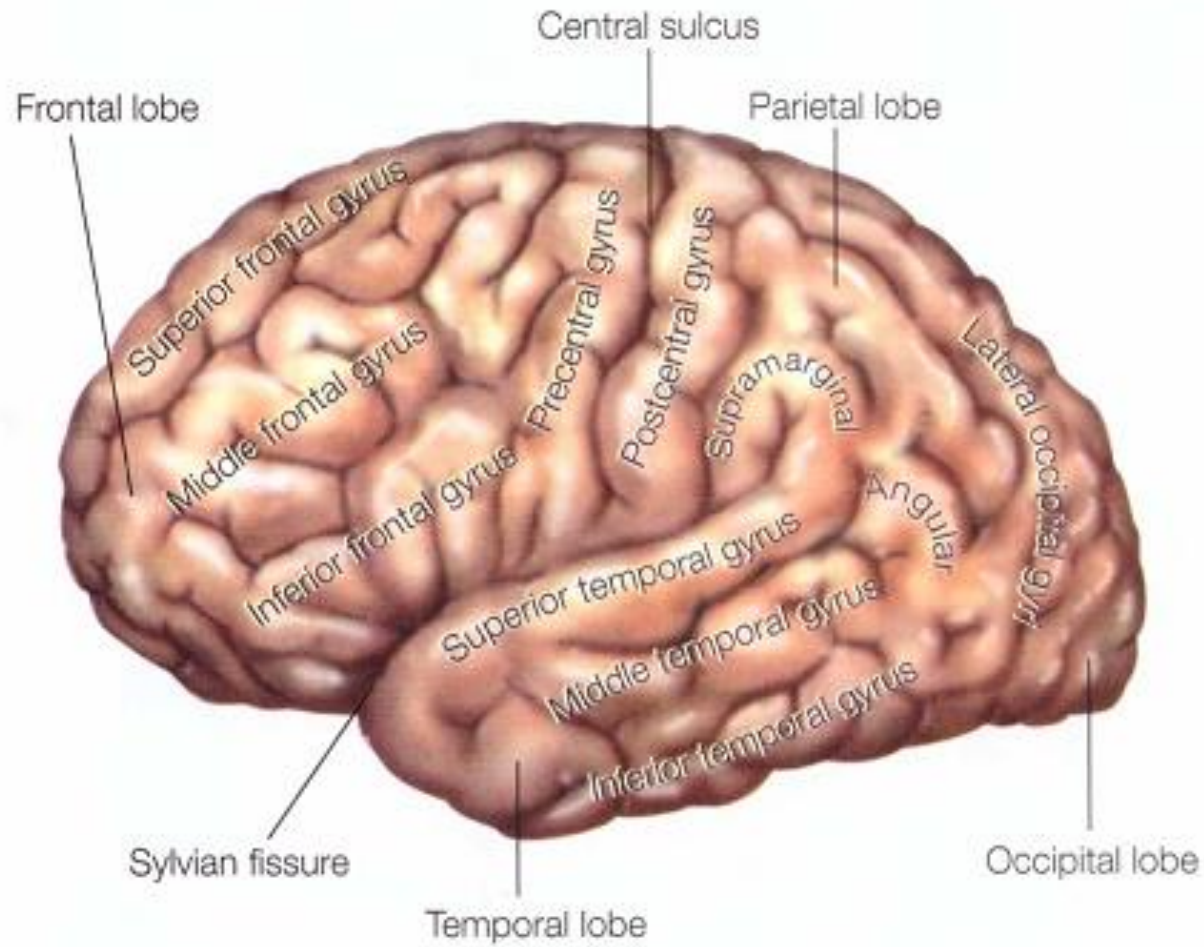


ANATOMY

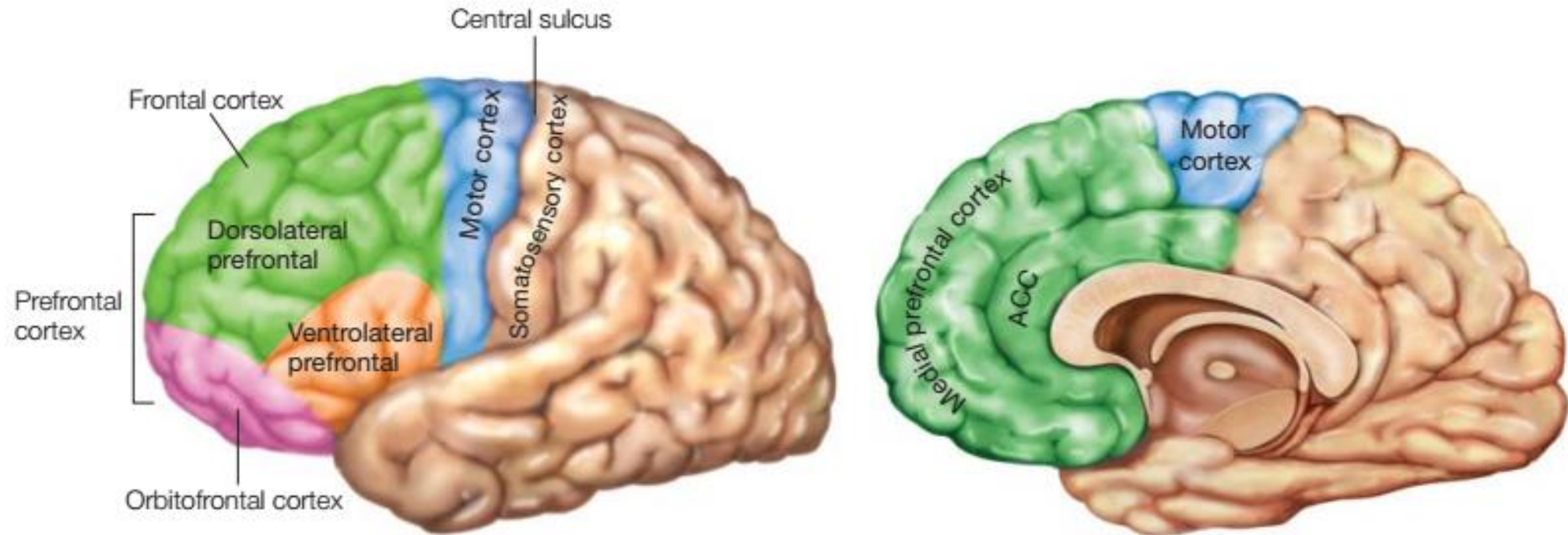


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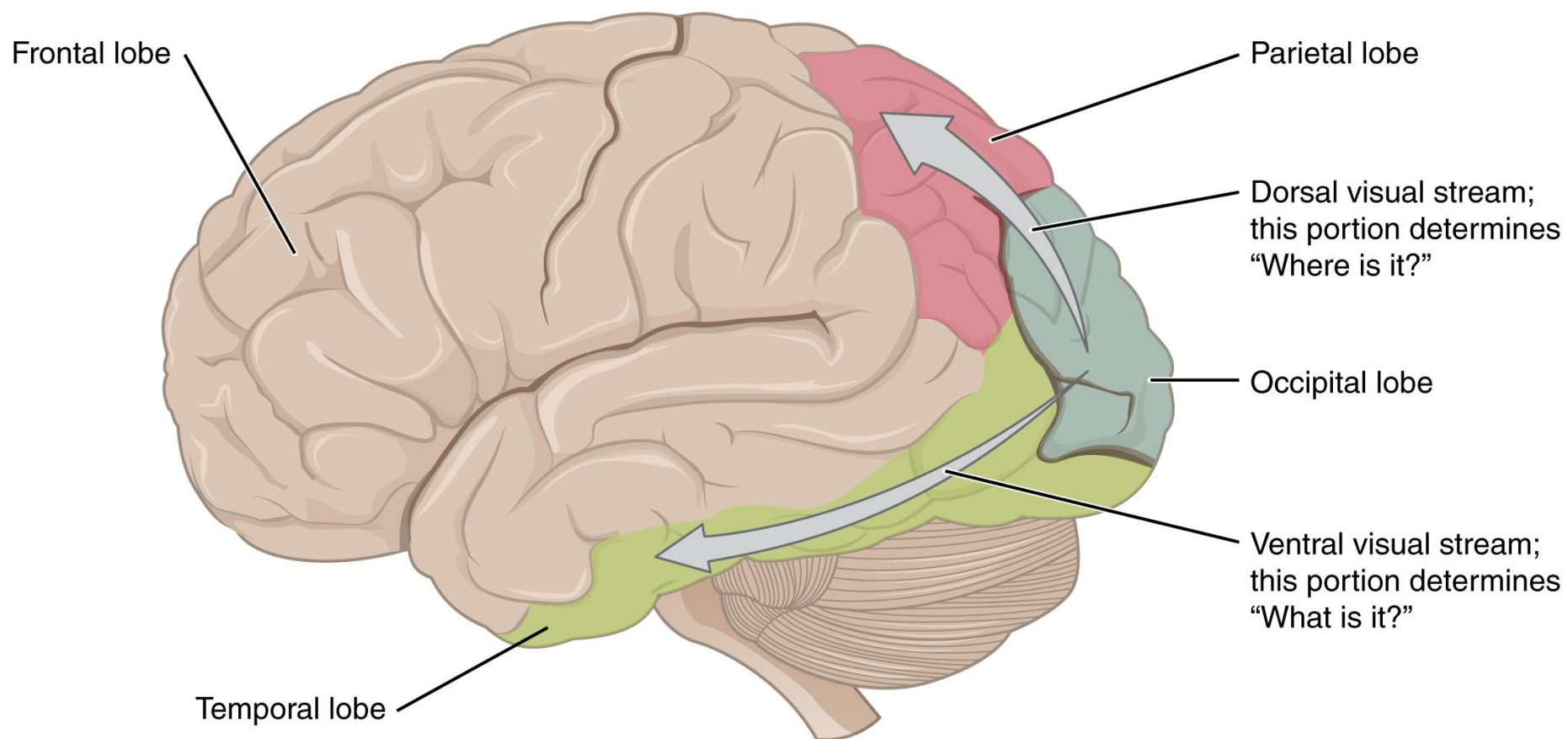


FUNCTIONAL DIVISIONS



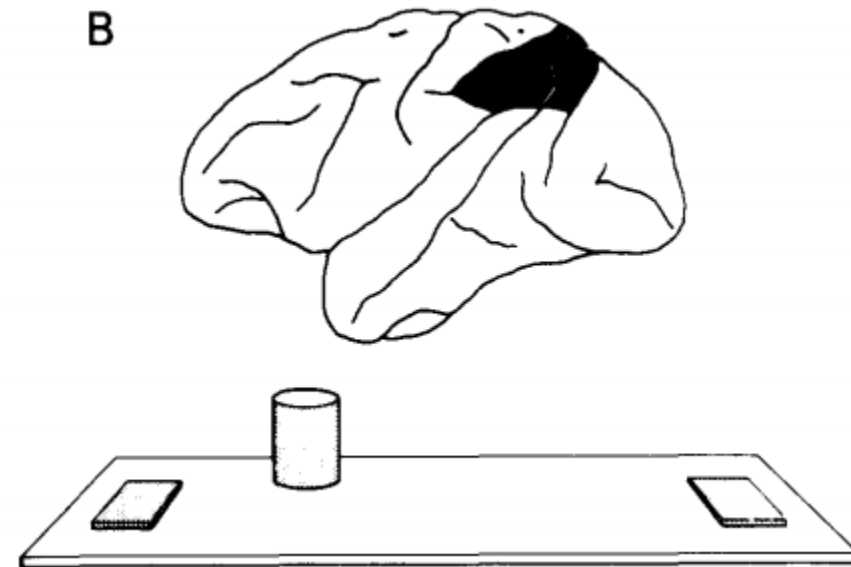
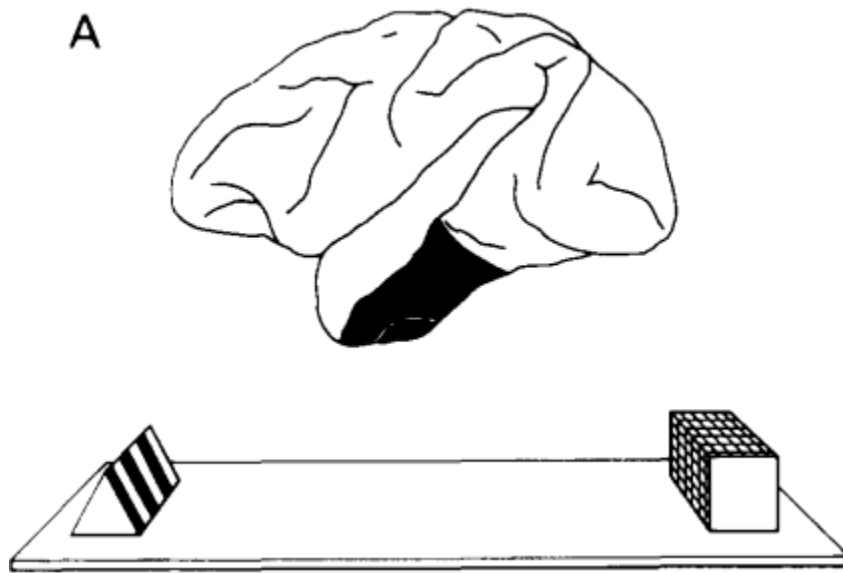
THE TWO VISUAL SYSTEM HYPOTHESIS

- Ungerleider and Mishkin, “Two cortical visual systems” (1982)



THE TWO VISUAL SYSTEM HYPOTHESIS

Cross-lesion disconnection experiments



- Q1. Summarize Ungerleider & Mishkin's experiments supporting "the two visual system hypothesis"



EXTENDING COMPUTATIONAL MODELING TO THE BRAIN

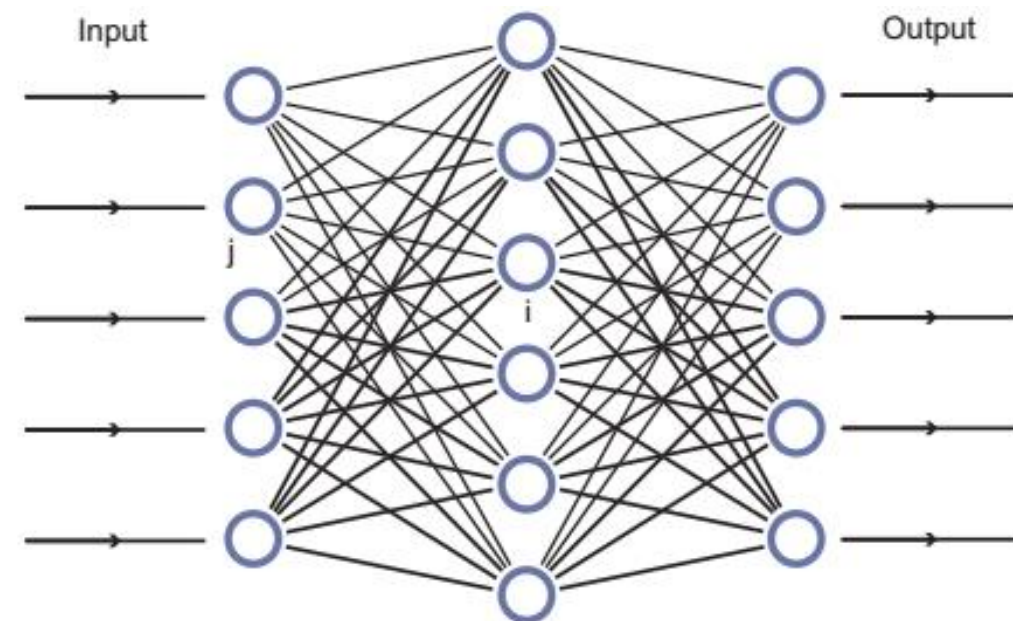


HARDWARE AND SOFTWARE

- Functional systems approach abstracts away from the details of neural machinery in thinking about the algorithms of cognition.
- However, when we start thinking about the computation speed in making cognitive decision, hardware matters (ex. Avoiding predators, etc)
- After all, our minds are realized in brains.
 - Degradation of our cognitive abilities is gradual. They are not all-or-nothing phenomenon.

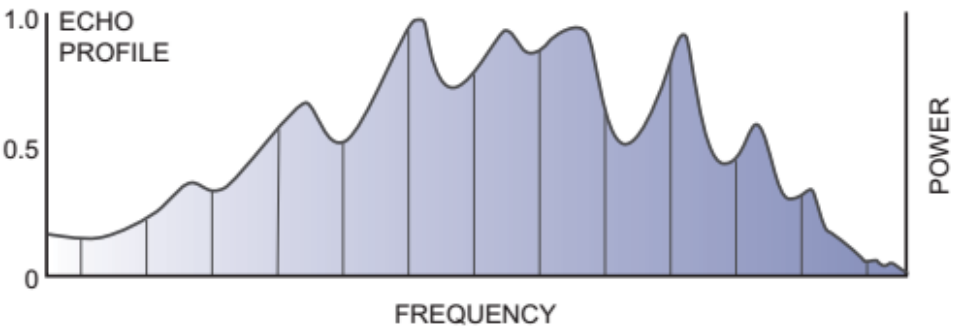
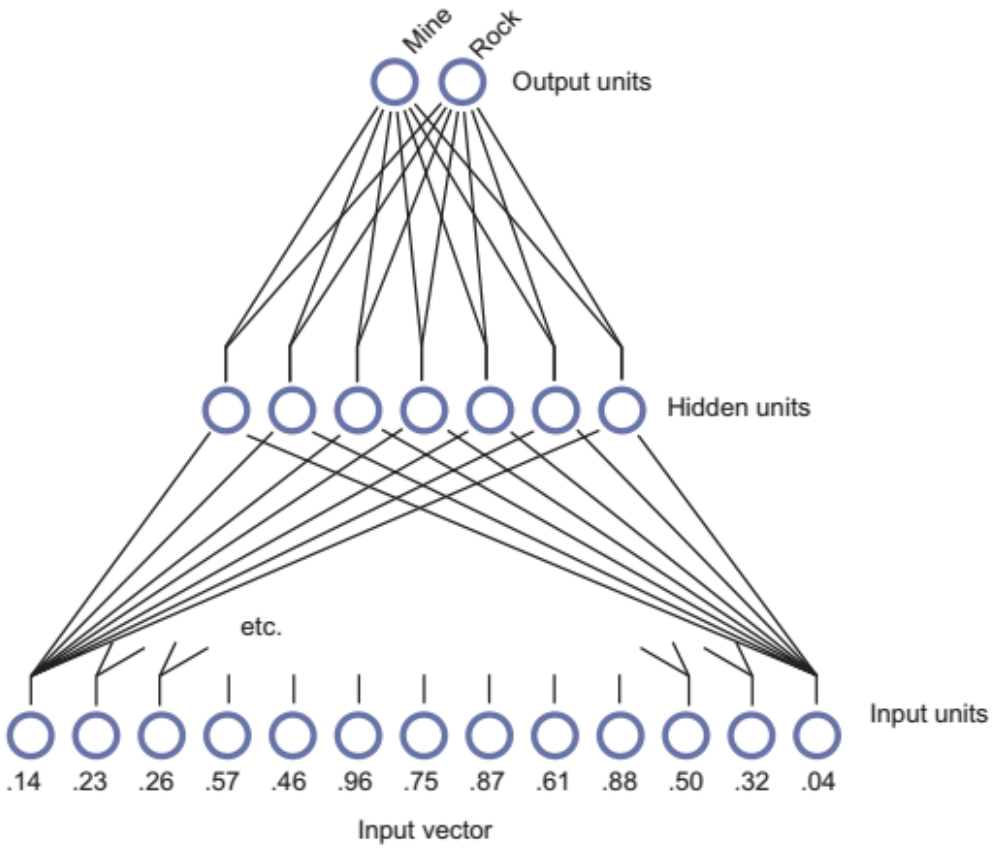
RUMELHART, MCCLELLAND, AND THE PDP RESEARCH GROUP

- *Parallel Distributed Processing: Explorations in the Microstructure of Cognition* (1986)
 - Artificial neural network
 - Parallel processing
 - Learning session exists: adjust weights to minimize the errors between targeted outputs and model outputs



PATTERN RECOGNITION IN NEURAL NETWORKS

- Gorman and Sejnowski's mine/rock detector

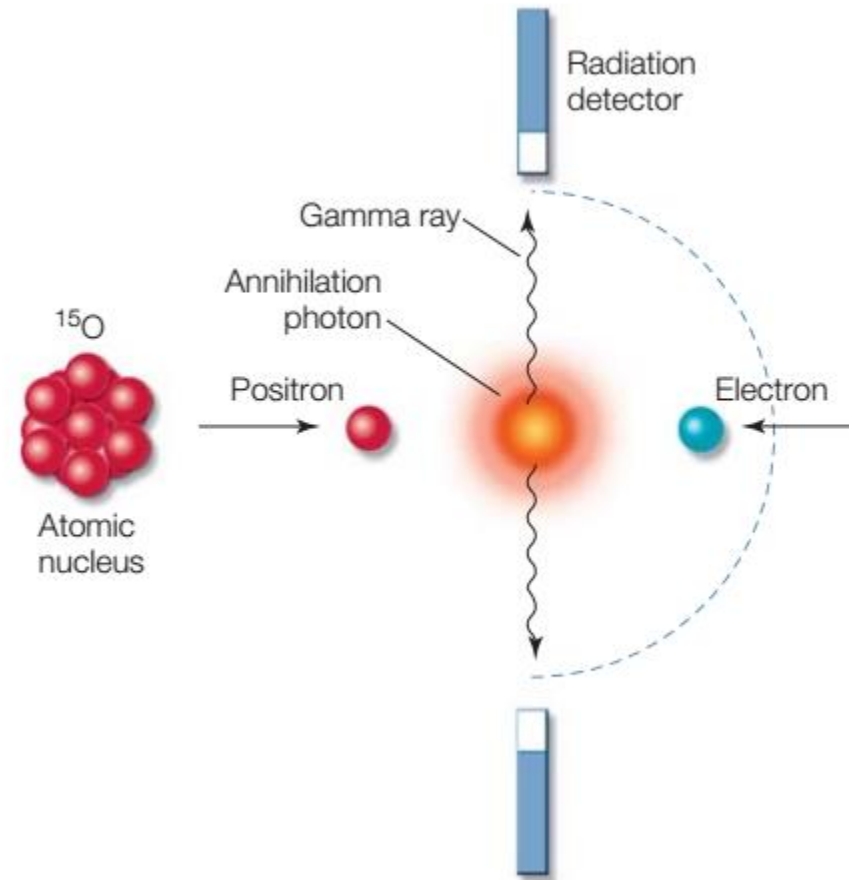




MAPPING THE STAGES OF LEXICAL PROCESSING



POSITRON EMISSION TOMOGRAPHY (PET)



POSITRON EMISSION TOMOGRAPHIC STUDIES OF THE CORTICAL ANATOMY OF SINGLE-WORD PROCESSING (1988)

- Information processing models of single-word processing (lexical access)
 1. Neurological model: Serial, Visual information about words appearance should be phonologically recoded.
 2. Cognitive model: Parallel, There are several channels that can feed into semantic processing

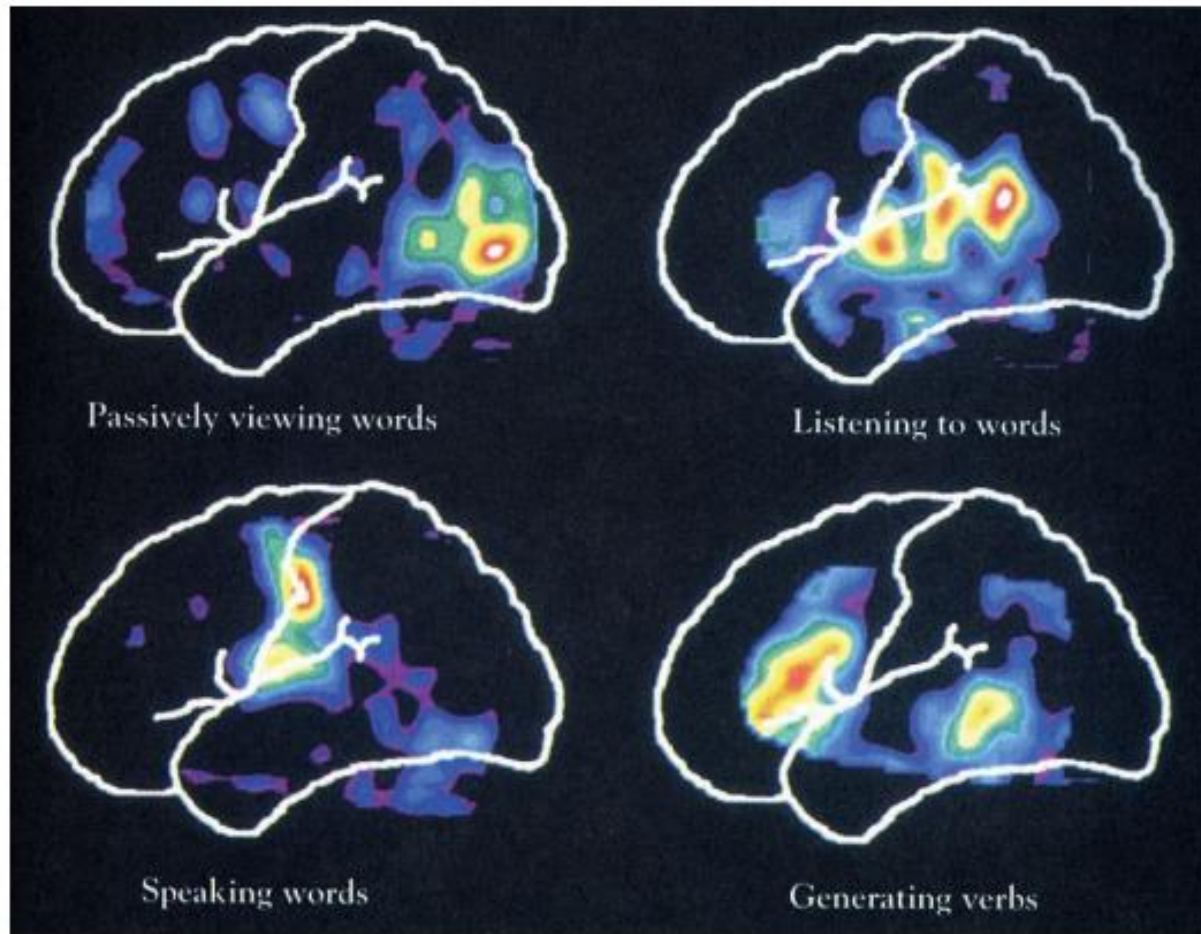
POSITRON EMISSION TOMOGRAPHIC STUDIES OF THE CORTICAL ANATOMY OF SINGLE-WORD PROCESSING (1988)

■ Experimental conditions

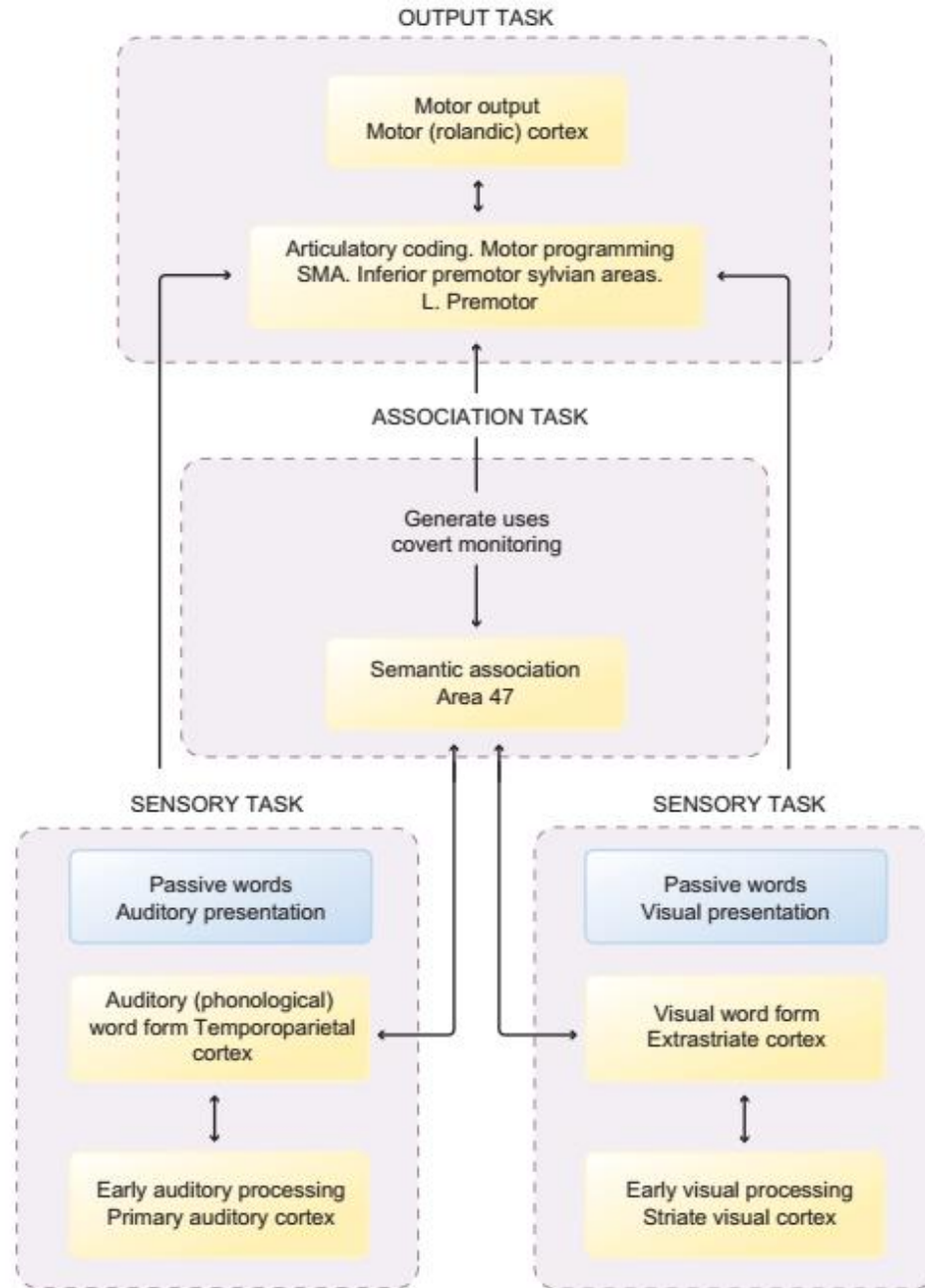
1. Fixation condition
2. Passive, visual presentation of words
3. Passive, auditory presentation of words
4. Say out loud the words appearing on the screen
5. Say out corresponding verb for a given noun appearing on the screen

POSITRON EMISSION TOMOGRAPHIC STUDIES OF THE CORTICAL ANATOMY OF SINGLE-WORD PROCESSING (1988)

The evidence against the neurological model



- Q2. Make a flowchart of neurological model for single-word processing



FLOWCHART FOR SINGLE-WORD PROCESSING