Perceptions of Reality: Seeing the World

Brain Awareness Week

March 14, 2022

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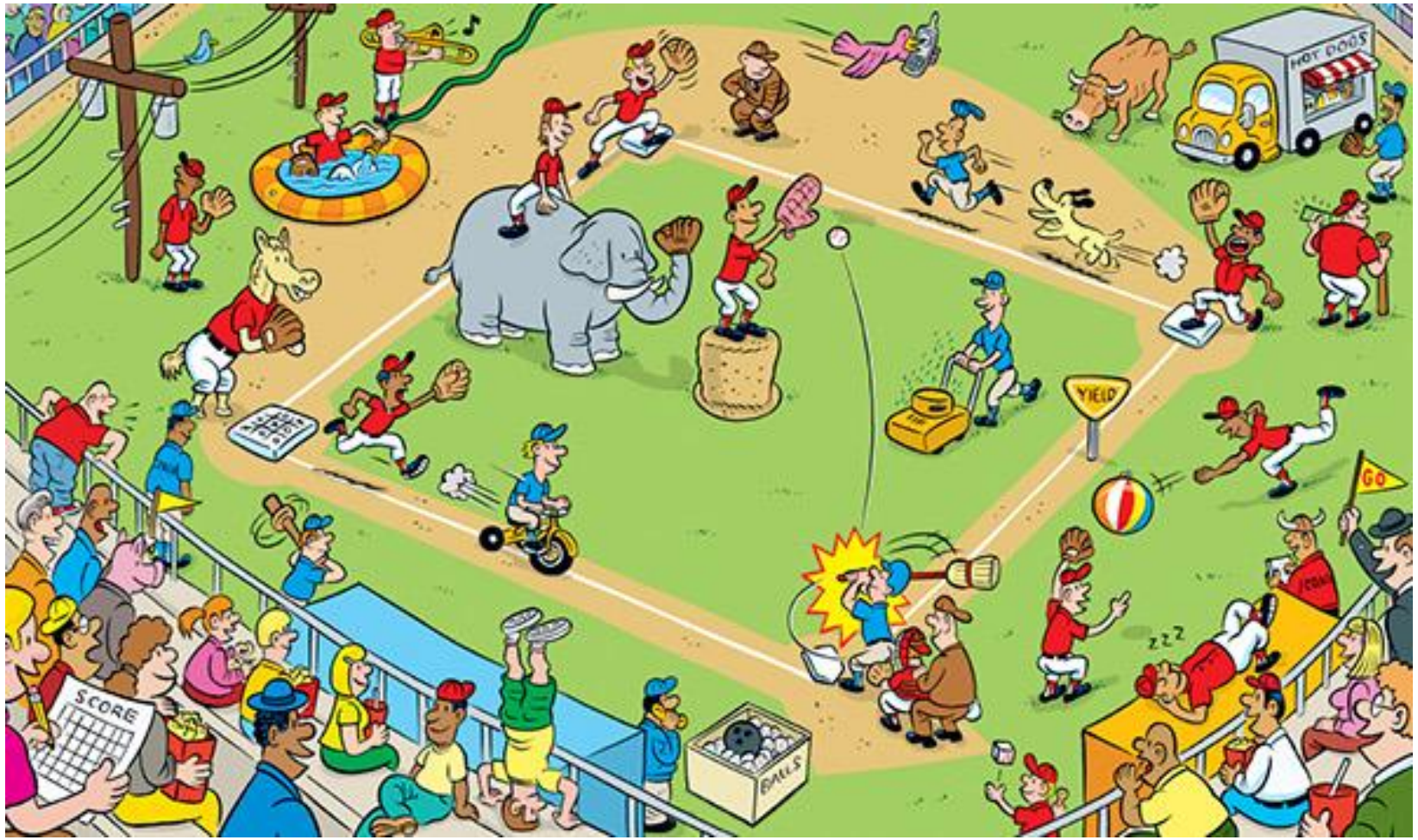
SUNY Empire State College

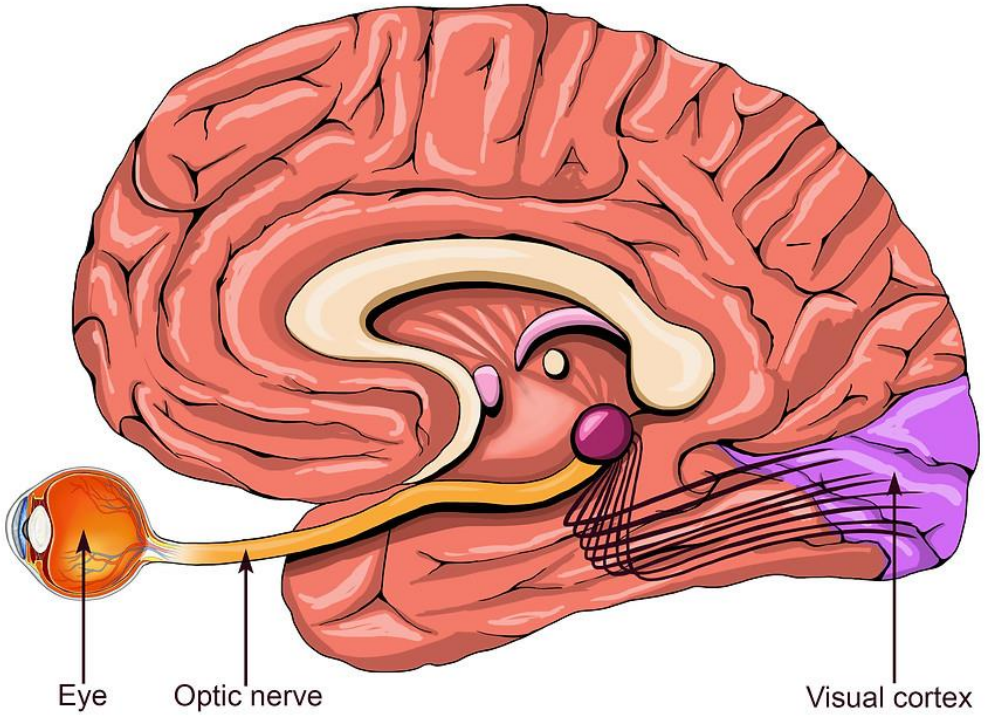
SUNY EMPIRE STATE COLLEGE

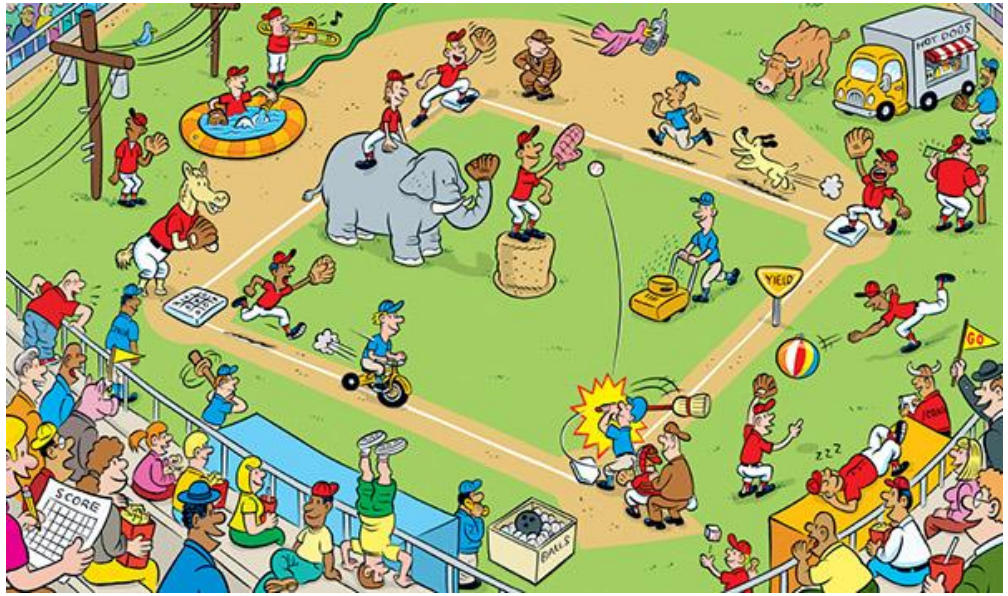
The Visual World is Complex



https://bmp-level.blogspot.com/2021/07/speech-therapy-picture-scene-for.html

Eye and Brain Must Work Together



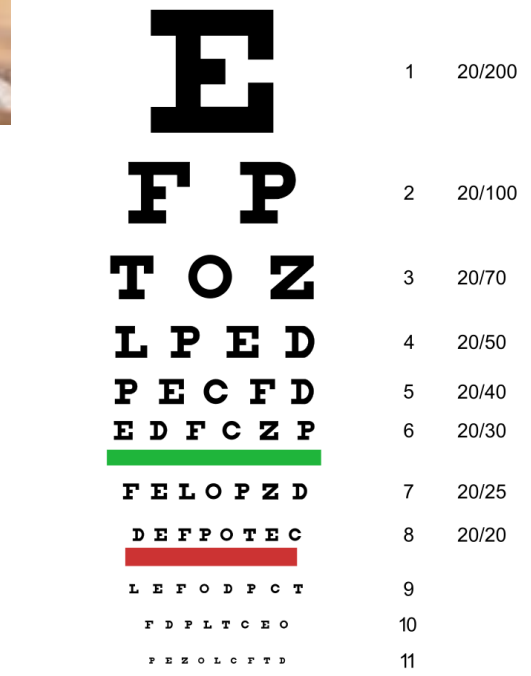


https://mammothmemory.net/biology/organs-and-systems/the-eye/optic-nerve.html
https://bmp-level.blogspot.com/2021/07/speech-therapy-picture-scene-for.html

Sight and Vision are Separate Processes

Sight

- The faculty of seeing
- Focused on the function of the eye
- Example: Snellen chart eye test



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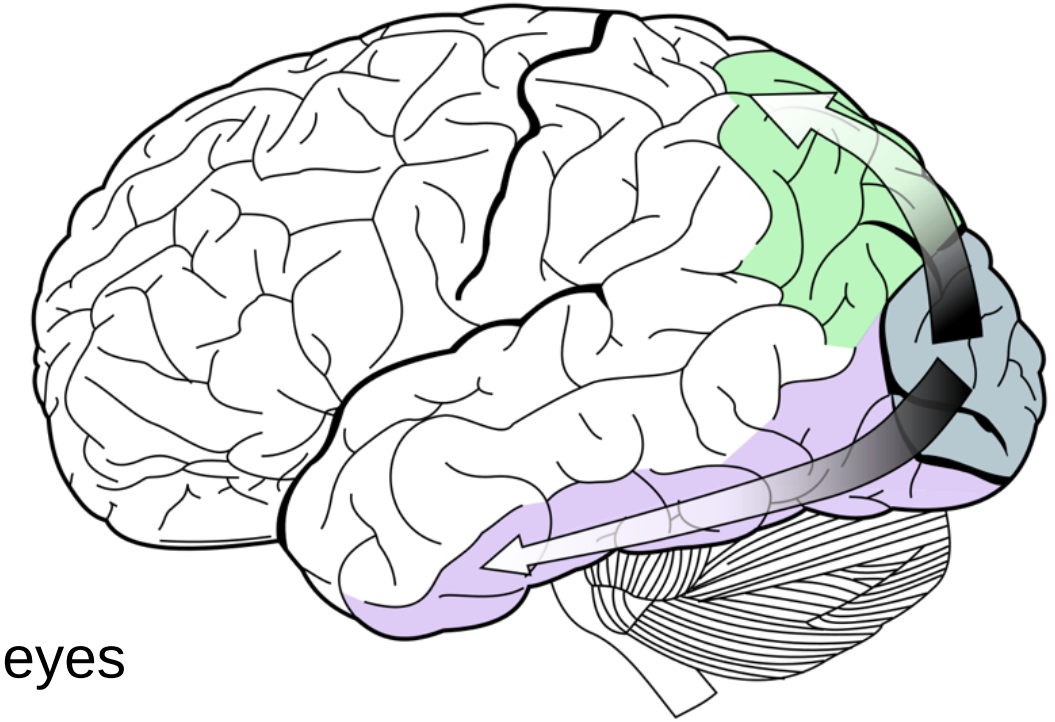
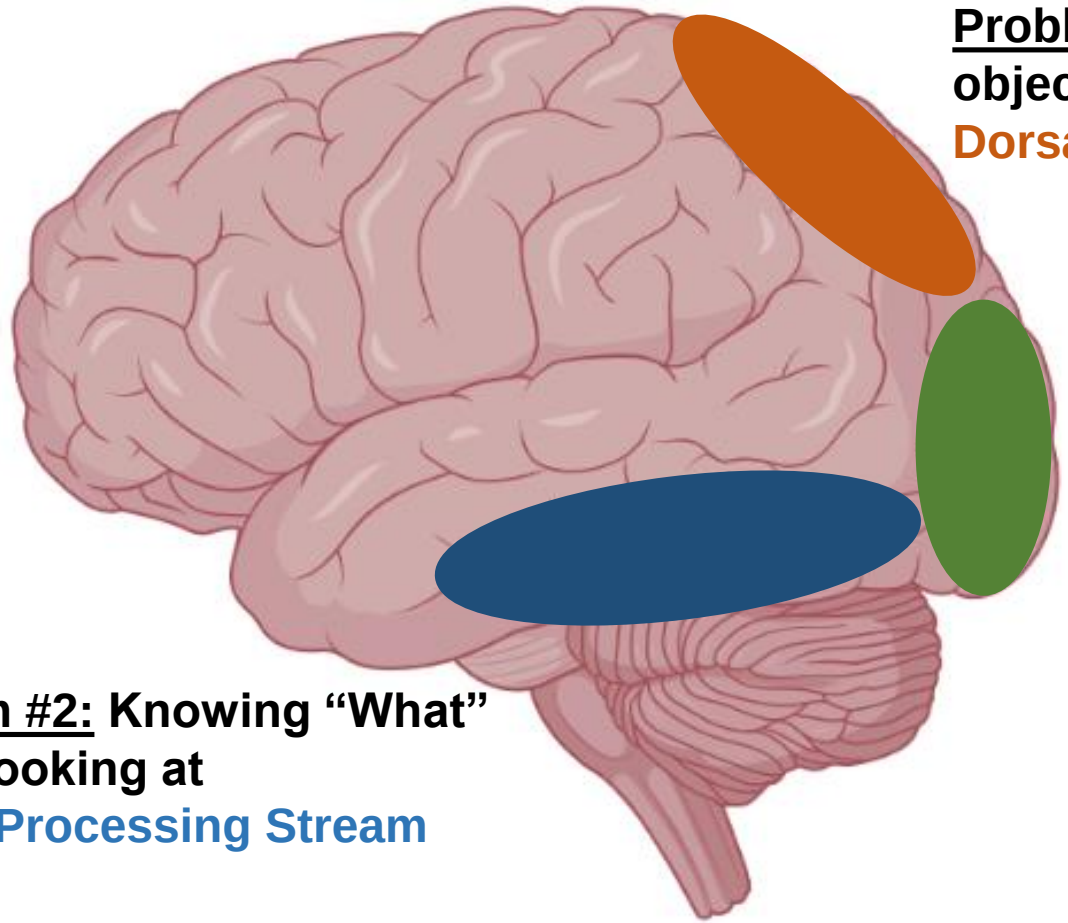


Vision

- How the brain processes information from the eyes
- Focused on brain areas that integrate visual information
- Examples: Conscious perception, perception of form, perception of motion

https://commons.wikimedia.org/wiki/File:Ventral-dorsal_streams.svg

The Brain Solves Three Visual Perception Problems

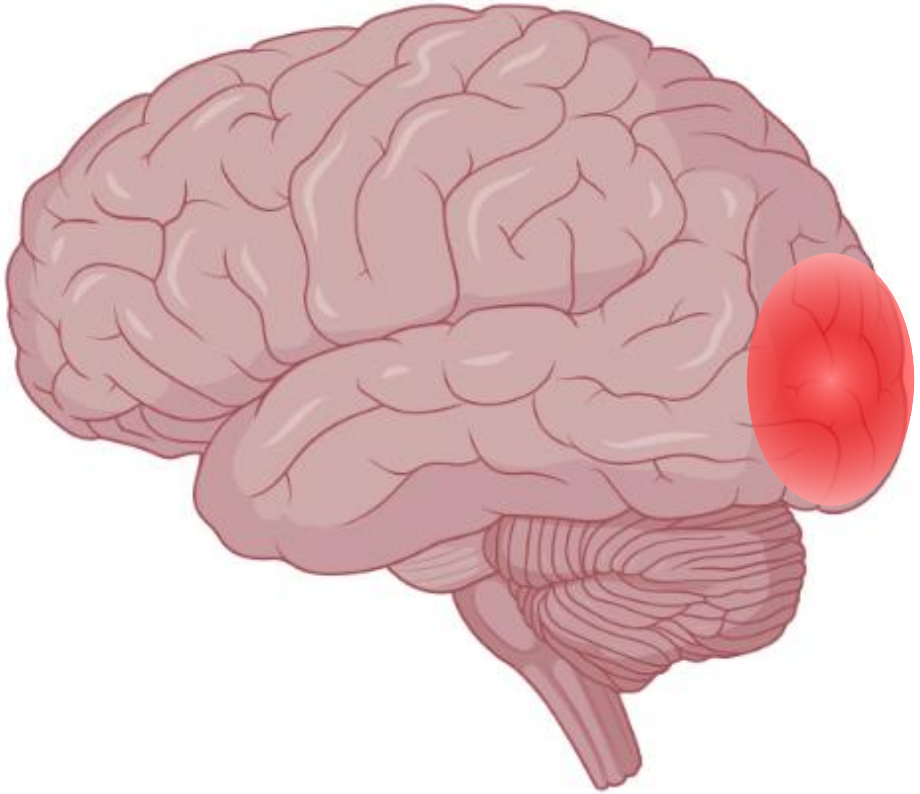


<u>Problem #3:</u> Knowing "Where" objects are in space
Dorsal Processing Stream

<u>Problem #1:</u> Being conscious of your own vision
Primary Visual Cortex

<u>Problem #2:</u> Knowing "What" you're looking at
Ventral Processing Stream

Problem #1: Conscious Awareness of Vision



Blindsight

Problem #1: Conscious Awareness of Vision

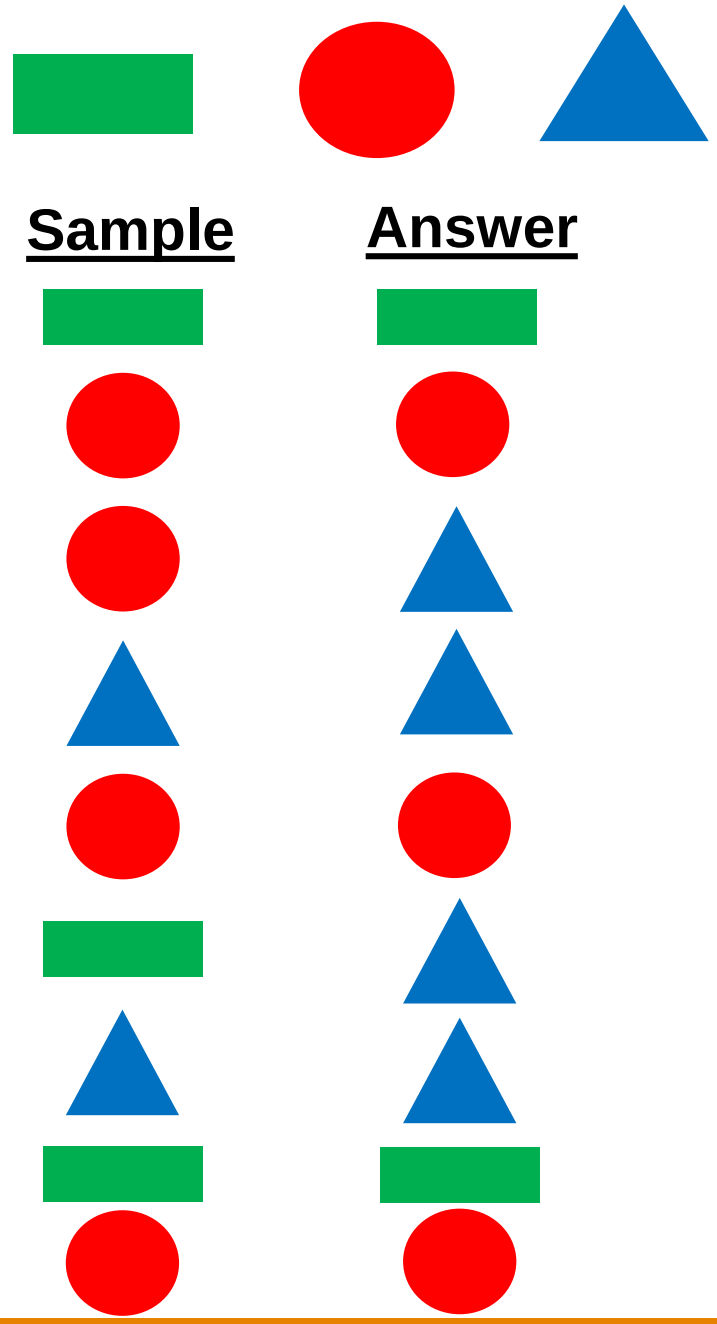
- Blindsight – Behaving “as if” conscious of vision but unable to explicitly perceive visual world

- Lawrence Weiskrantz – 1970s
- Patients who suffered V1 lesions during their life
  - Famous patient – D.B.
- Legally blind – cortical blindness

- Tested patients for their ability to correctly guess visual objects shown to them

https://royalsocietypublishing.org/doi/10.1098/rsbm.2019.0045

Blindsight

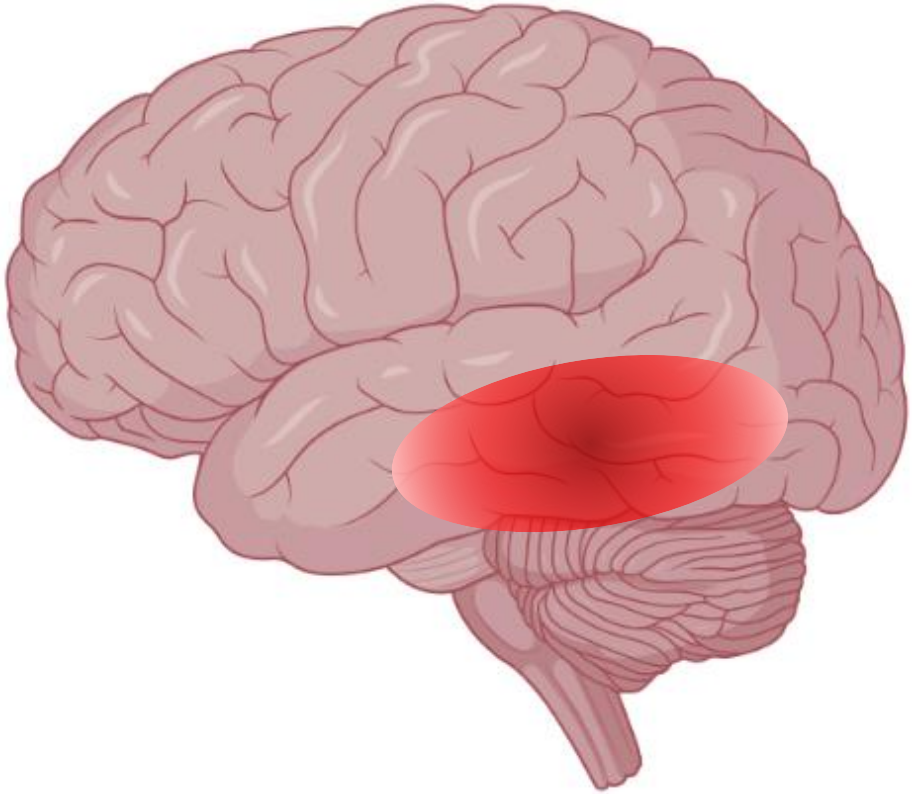


Chance
3/9 correct
(33%)

Actual
7/9 correct
(78%)

Patients not able to declare what they saw, but guessed correctly most of the time

Problem #2: Knowing “what” you’re looking at



Ventral Pathway

- Extends from primary visual cortex toward temporal lobe
- Temporal lobe contains *fusiform gyrus* – important for recognizing faces and objects

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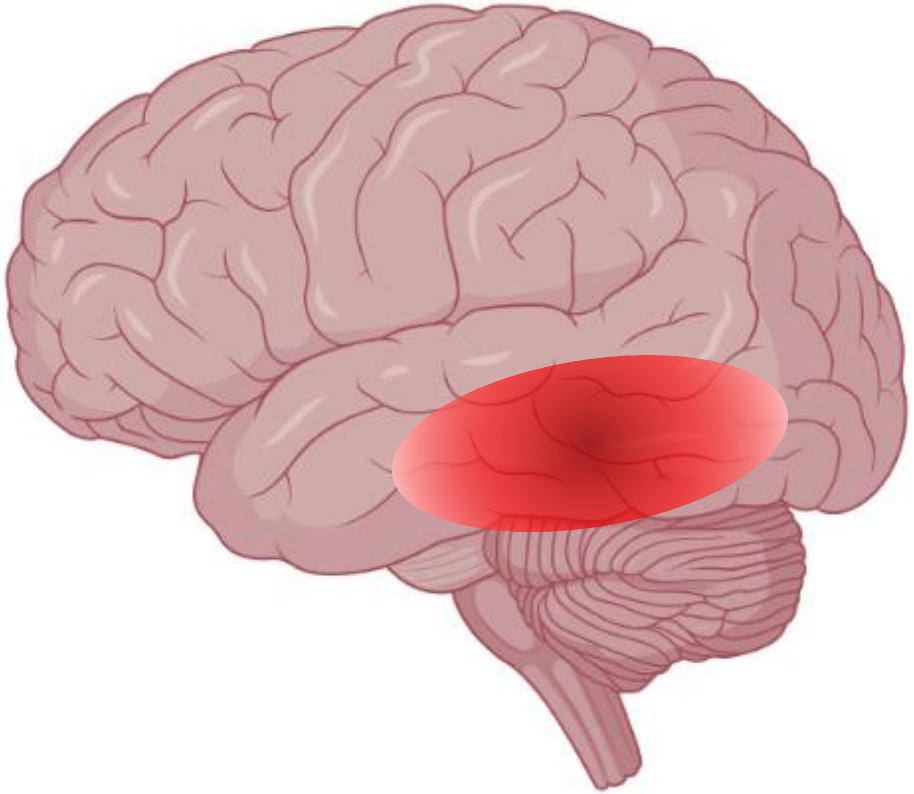

Prosopagnosia (face blindness)

https://www.shutterstock.com/image-vector/3d-faceless-mannequin-bust-head-1330922030

Problem #2: Knowing “what” you’re looking at

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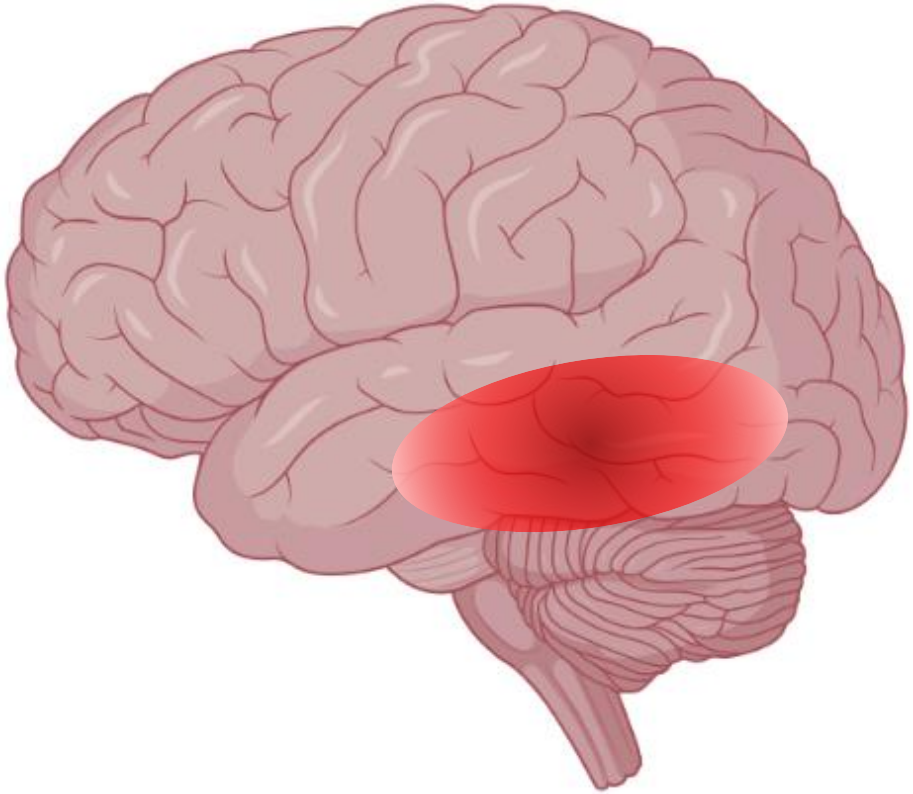

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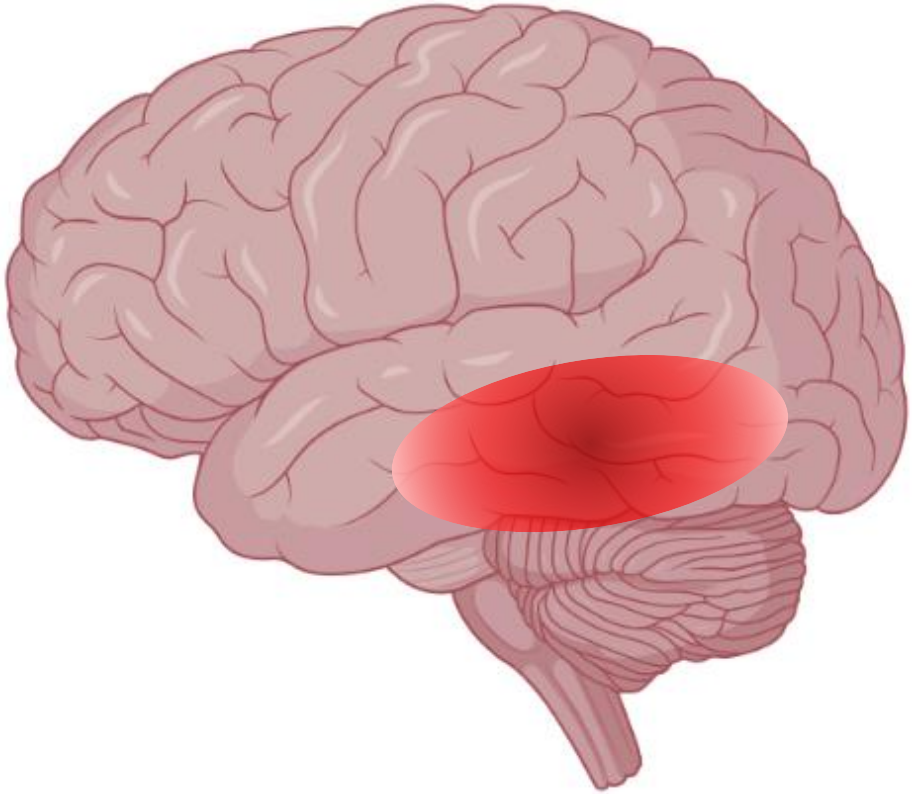

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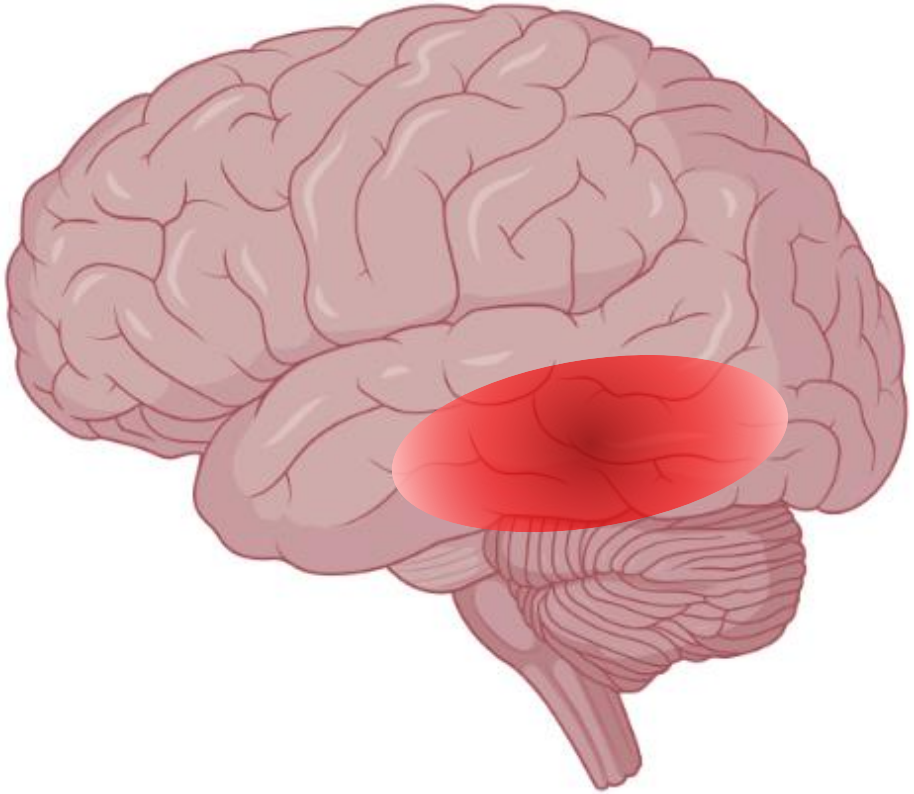

https://vangoyourself.com/paintings/vertumnus/

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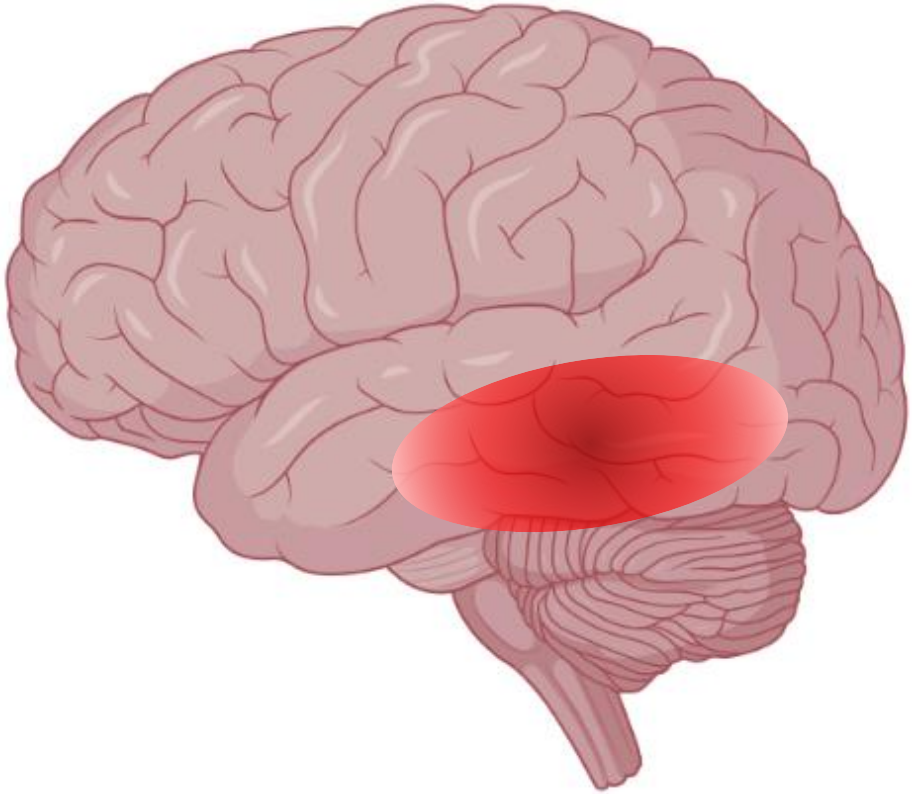

No problems with “sight”

No cognitive deficits

Typical overall functioning

Prosopagnosia (face blindness)

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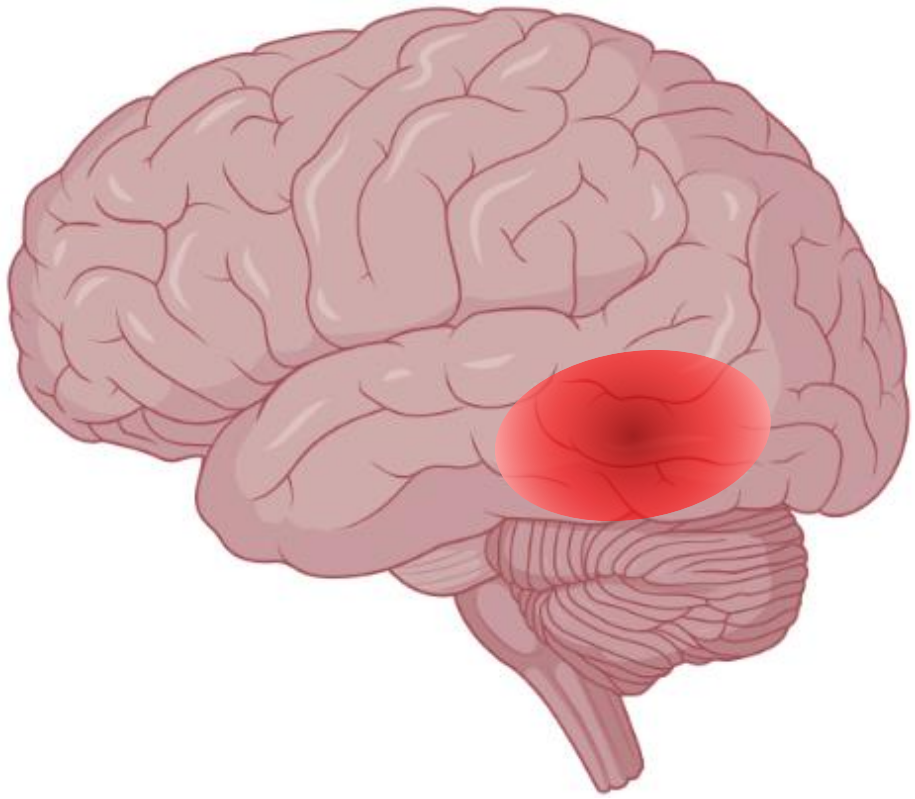

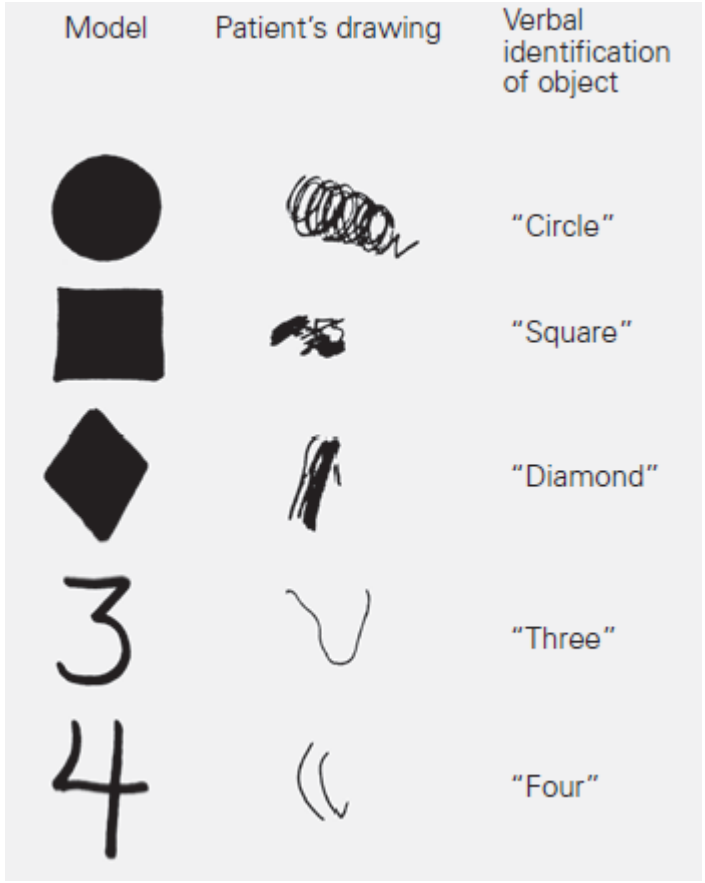

Cannot see parts as a unified whole

Difficulty constructing sensory “models” of external world

Apperceptive agnosia

Farah (1990) The MIT Press

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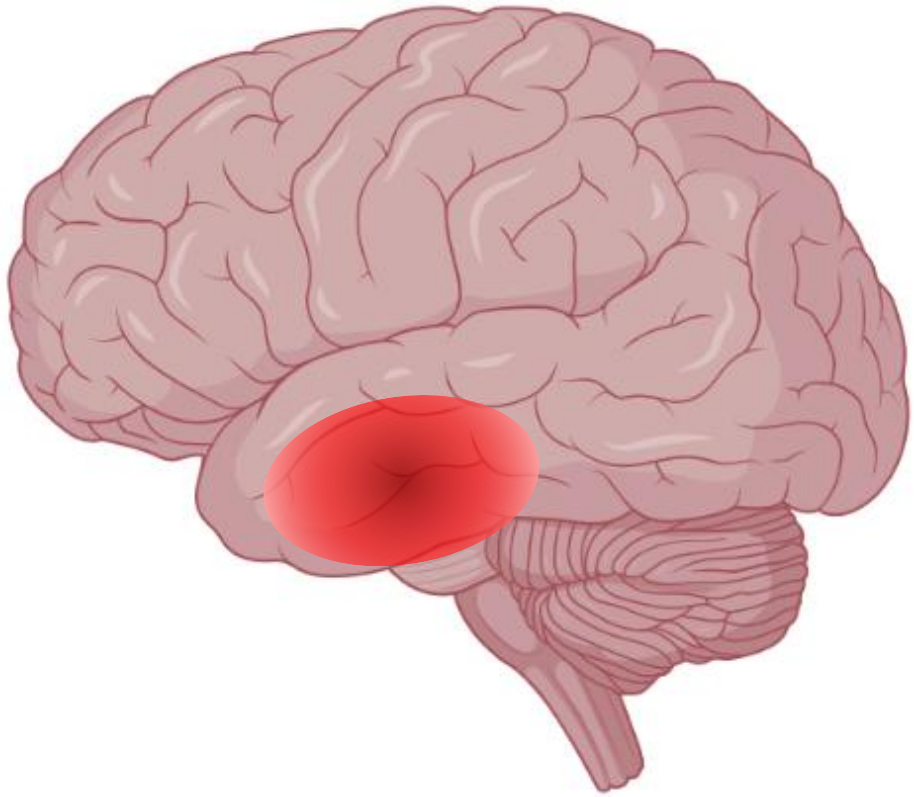
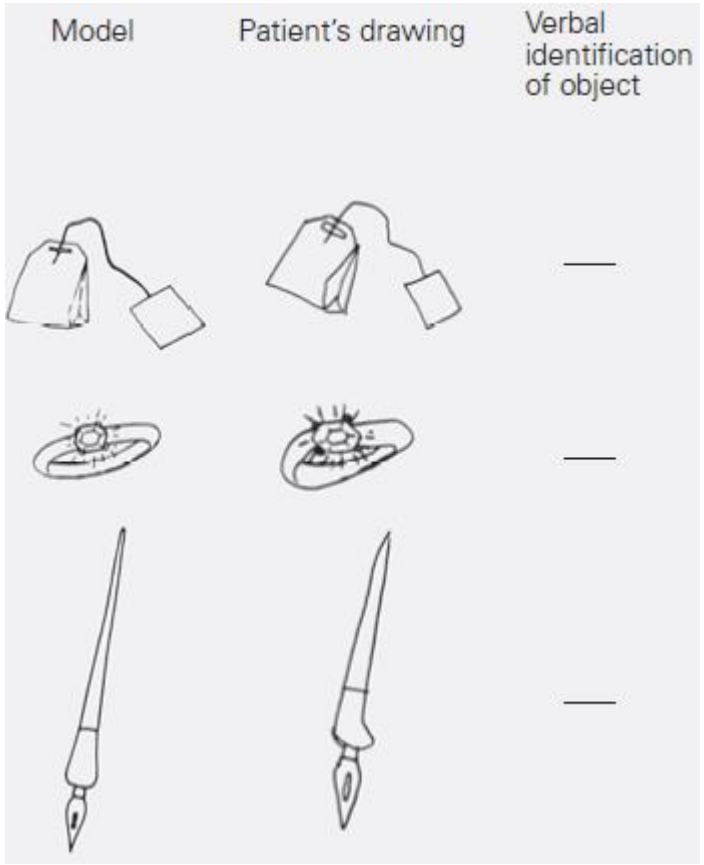




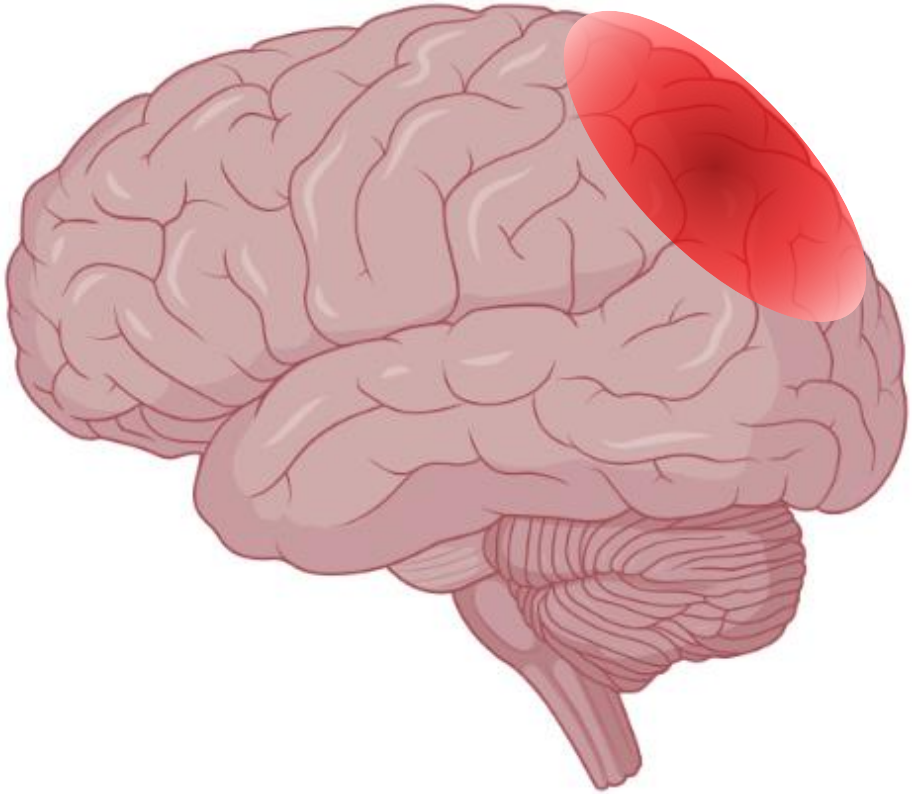
Cannot understand or assign meaning to objects

Sensory representation not affected, but no “meaning” in representations

Associative agnosia

Farah (1990) The MIT Press

Problem #3: Knowing “where” objects are in space



Akinetopsia (motion blindness)

https://www.dailymotion.com/video/x43dmj1

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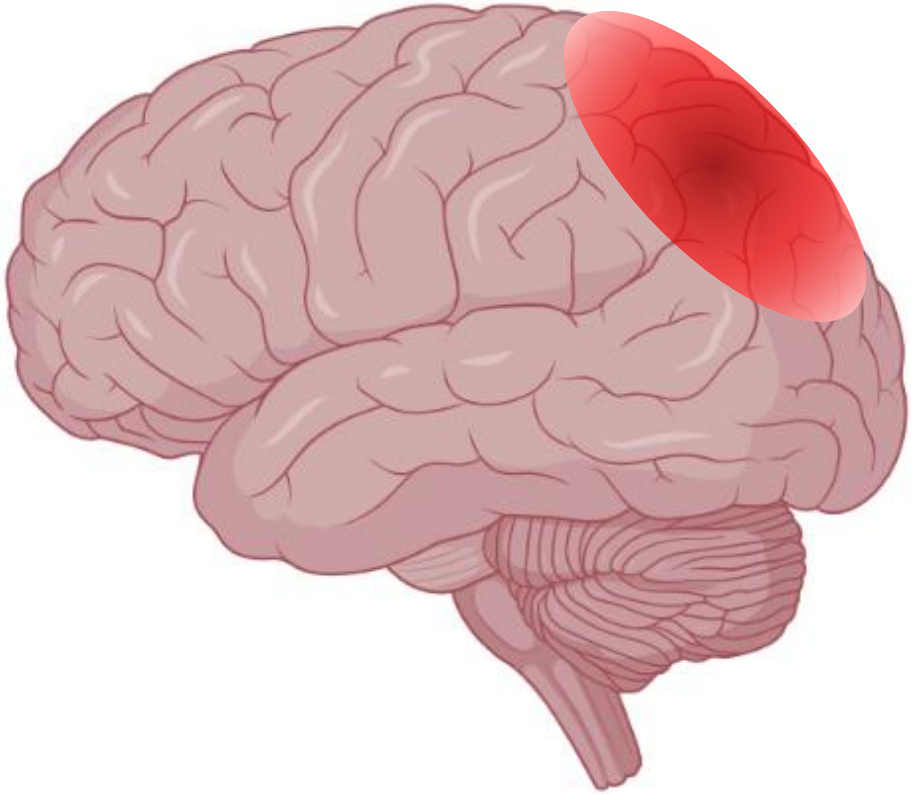

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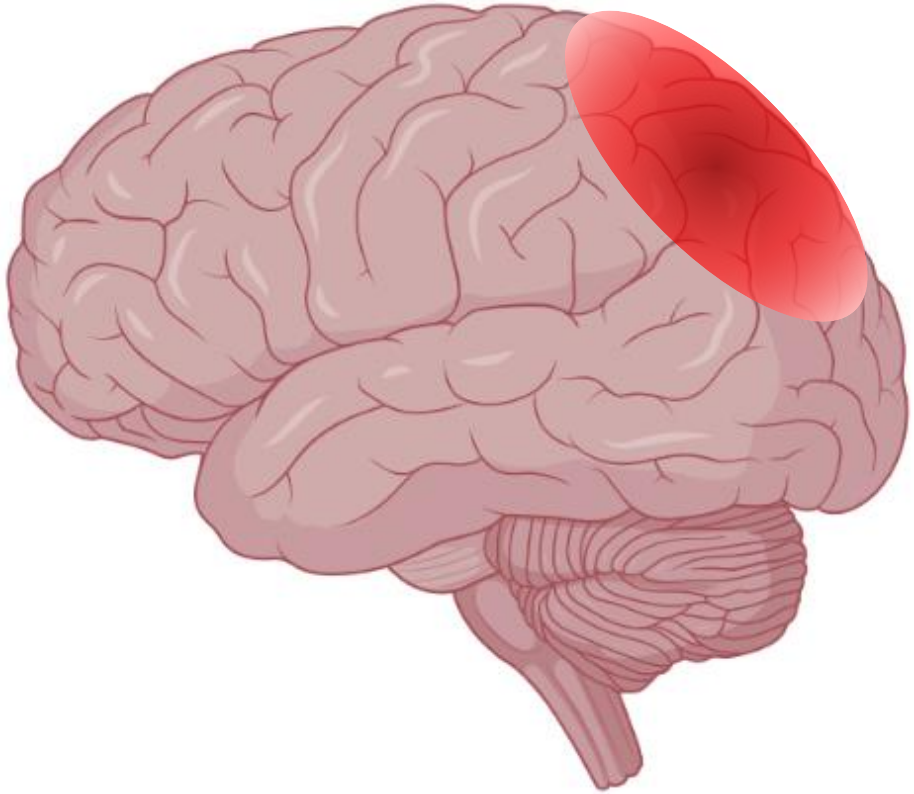

Brain (1983), **106**, 313–340

SELECTIVE DISTURBANCE OF MOVEMENT VISION AFTER BILATERAL BRAIN DAMAGE

by J. ZIHL, D. VON CRAMON *and* N. MAI

(*From the Max-Planck-Institut für Psychiatrie, Kraepelinstrasse 10, D-8000 München 40, FRG*)

Patient L.M.

- Difficulty pouring a cup of tea
- Overwhelmed in crowded rooms
- Difficulty crossing the street

Akinetopsia

Zihl, Cramon, & Mai (1983)

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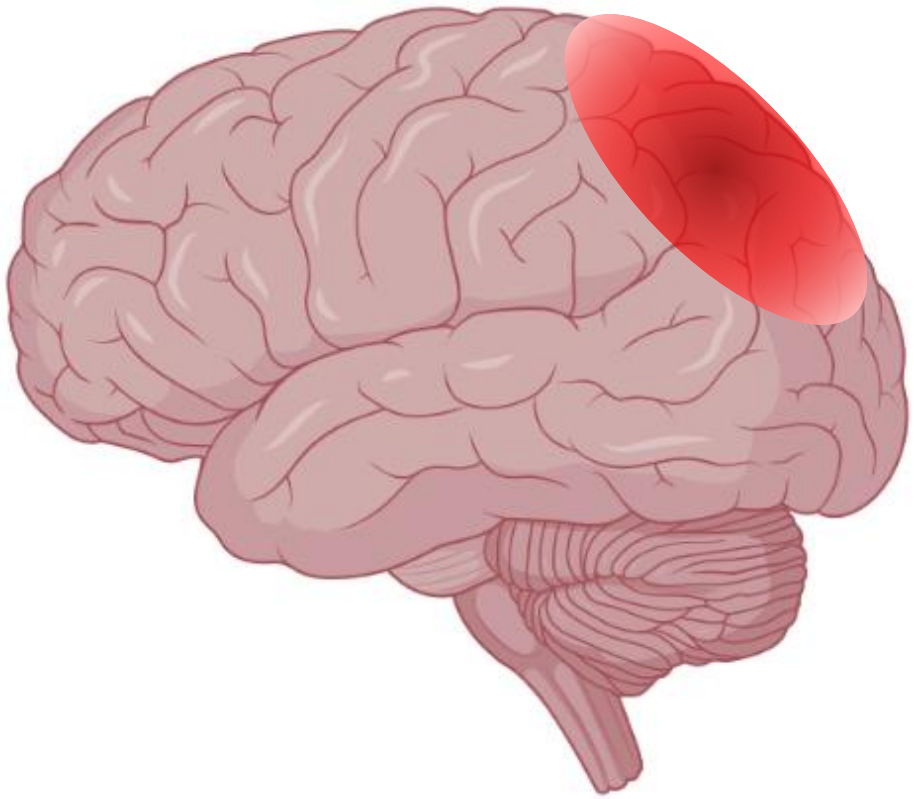
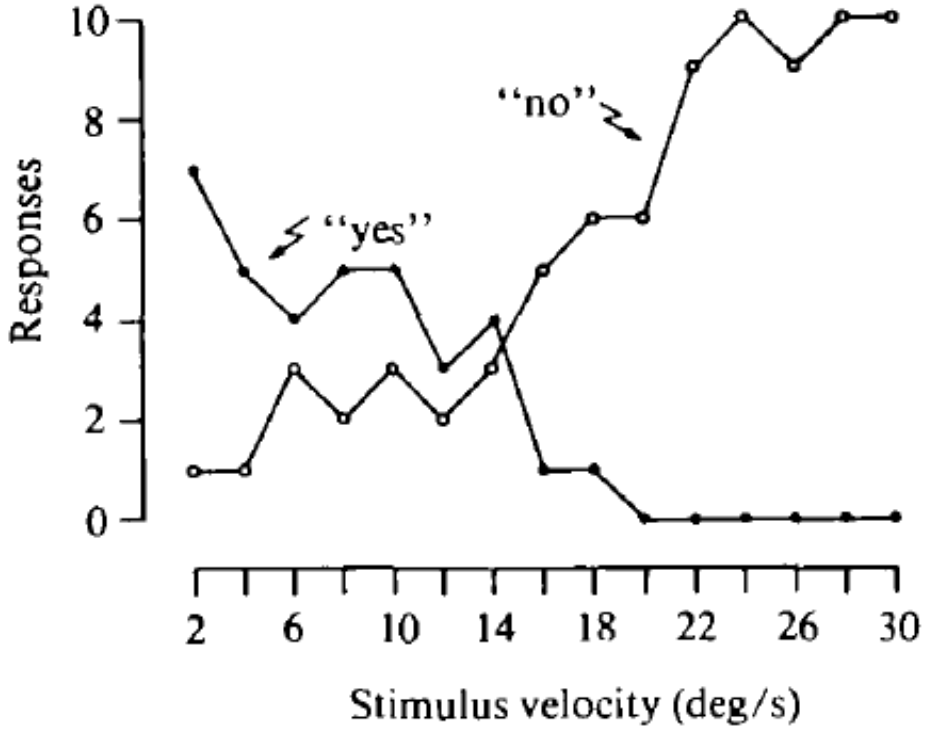


Detecting a moving dot



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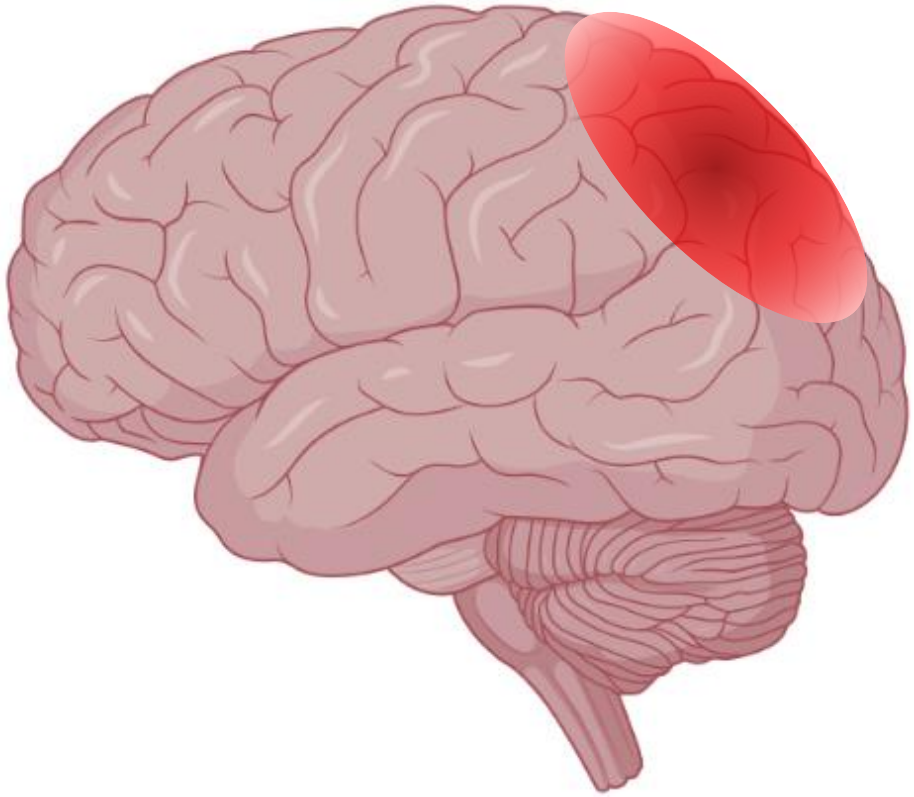
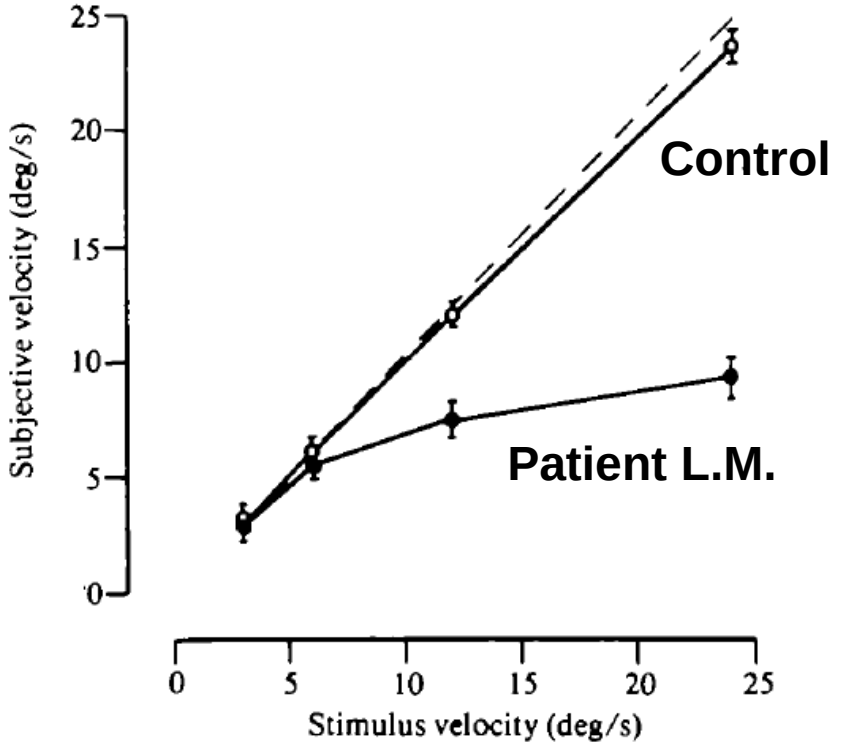


Estimating object speed



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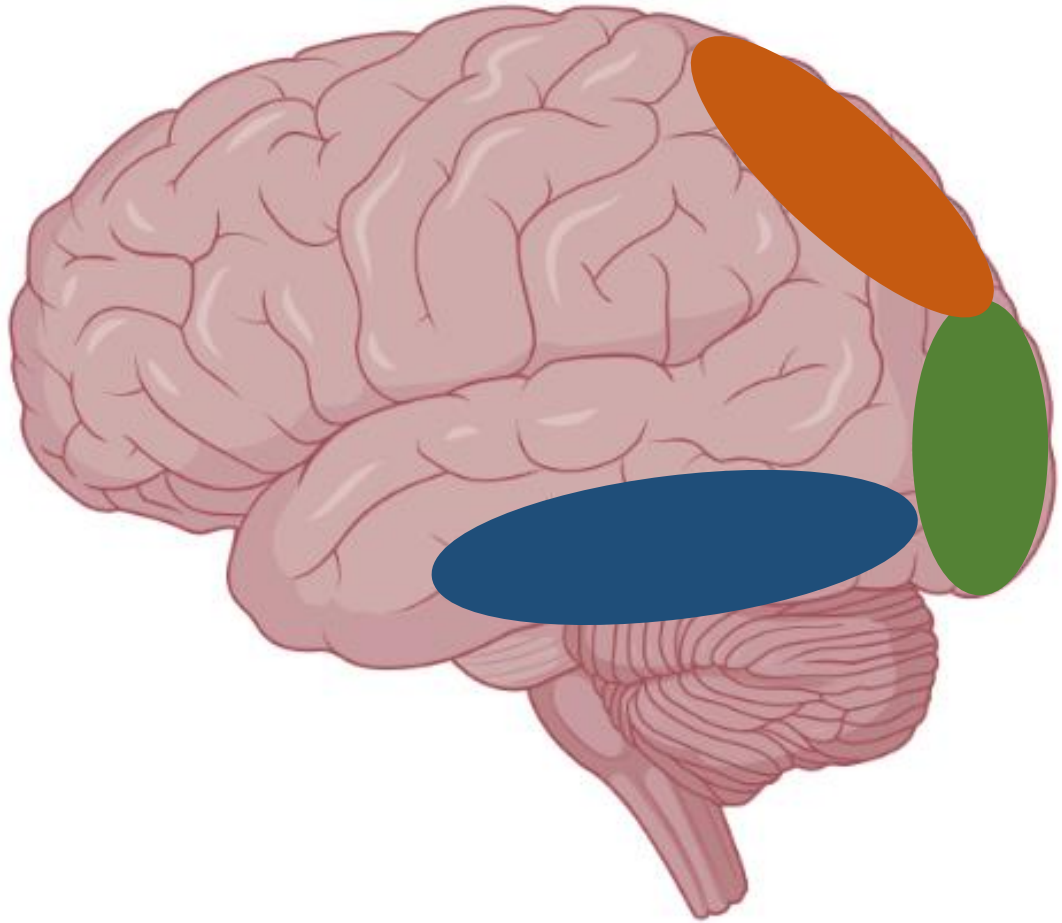
The Brain Uses Multiple Systems to Generate Visual Perception

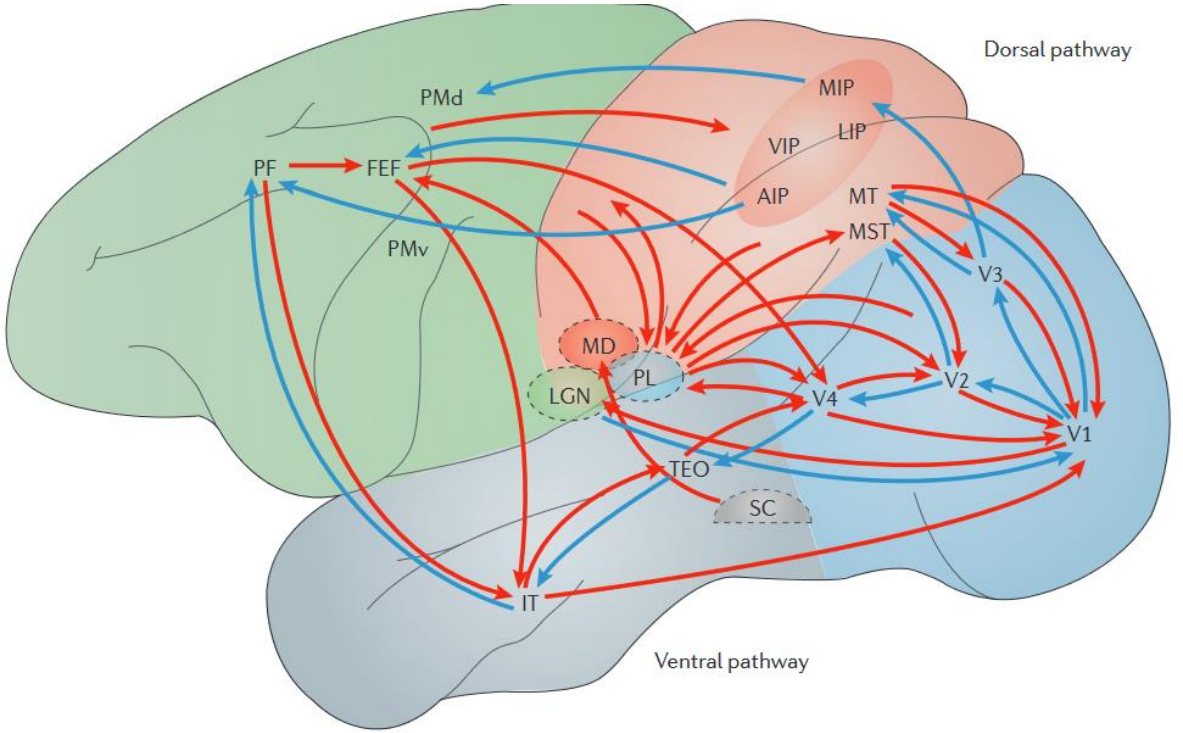
- Vision is the product of a collaborative effort from many brain regions

- Damage to these circuits can cause very specific visual deficits without sensory or cognitive effects



The Brain Uses Multiple Systems to Generate Visual Perception

- Vision is the product of a collaborative effort from many brain regions
- Damage to these circuits can cause very specific visual deficits without sensory or cognitive effects
- Vision (perception) is a complex, distributed process that helps us create a model of our world



Gilbert & Li (2013)