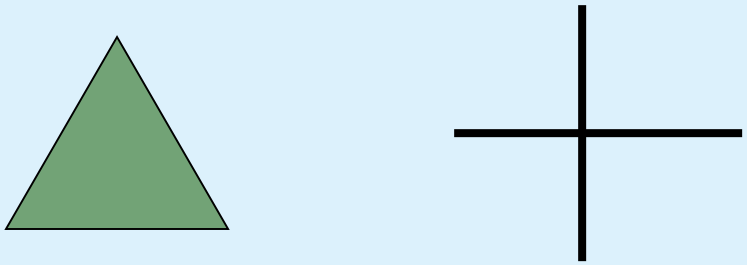
Demonstration
Left and right hemispheres

Split-Brain Studies

What do you see?

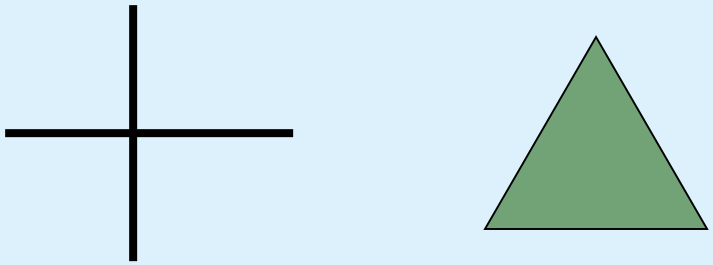


“Nothing”

Left Visual Field-> Right Hemisphere -> Can’t Speak

Split-Brain Studies

What do you see?

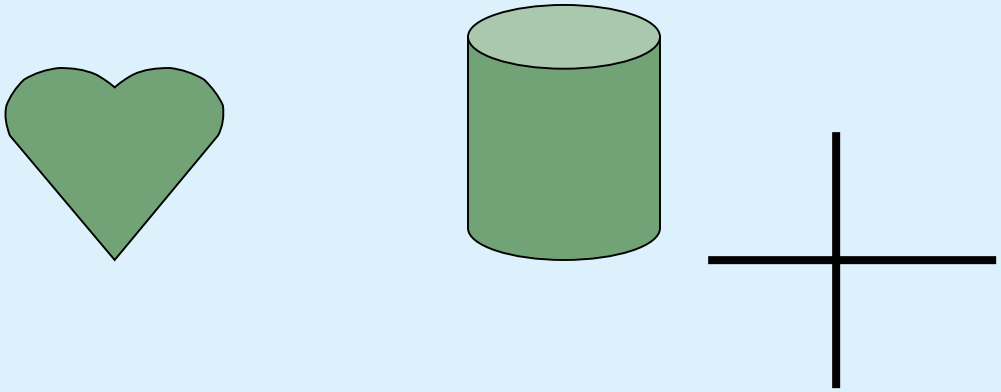


“Triangle”

Right Visual Field-> Left Hemisphere -> Can Speak

Split-Brain Studies

Point to correct match

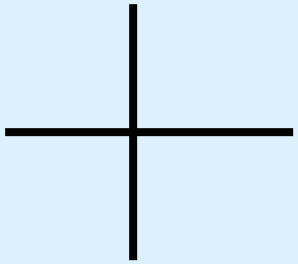


“Heart”

Left Visual Field-> Right Hemisphere -> Can understand
Simple words -> Can Point

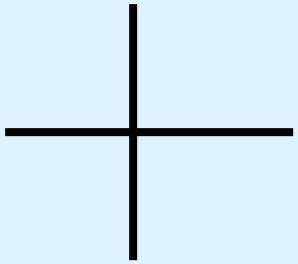
Split-Brain Studies
Language in both hemispheres

"What is your name?"



"Bob"

Split-Brain Studies
Language in both hemispheres

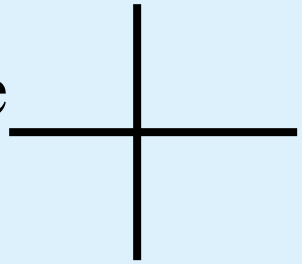


"What is your name?"

"Bob"

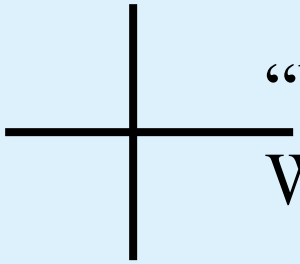
Split-Brain Studies
Language in both hemispheres

"What do you want to be
When you grow up?"



"I want to be a director of independent films
And then sell out to major studios and
Make a bundle"

Split-Brain Studies
Language in both hemispheres

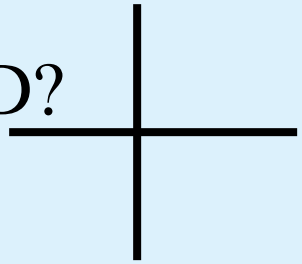


"What do you want to be
When you grow up?"

"I want to be a professional hockey player"

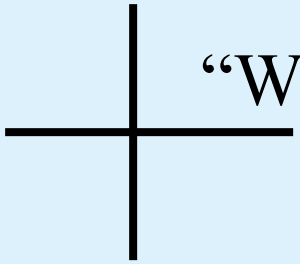
Split-Brain Studies
Language in both hemispheres

"What's your favorite CD?



"Taylor Swift"

Split-Brain Studies
Language in both hemispheres



"What's your favorite CD?

"Ozzy Osbourne – Heavy Metal"

Split-Brain Studies

Two people in this guys head?

More than two people?

How many in your head?

“Feels like” one person, but is this an illusion?

The man with two brains

Hemispheric dominance

Revealed by neurological patients

Left	Right
Most language,	Attention
grammar,	Spatial processing
naming	Faces
repeating,	
understanding	
Verbal memory	Nonverbal memory

Brain Pain

Emotional reactions to unilateral brain damage.

(Gainotti 1969)

	Left Hemi Damage	Right Hemi Damage
catastrophic	62%	10%
indifference	11%	38%

Catastrophic reaction

Despair, hopelessness or anger

Indifference reaction

Euphoric reaction - minimisation of symptoms, placidity or elation.

I'm half asleep

- **WADA test –**
  - Inject anesthetic (sodium amytol) into the right or left internal carotid artery
  - Puts one hemisphere to sleep so we can see what functions are there

Words of the brain

Language representation as revealed by sodium amytal test. (from Ramussen and Milner 1977)

	Language Center		
	Left Hemi	**Right Hemi**	**Bilateral**
Left-handers	**70**	**15**	**15**
Right-handers	**95**	**5**	**0**

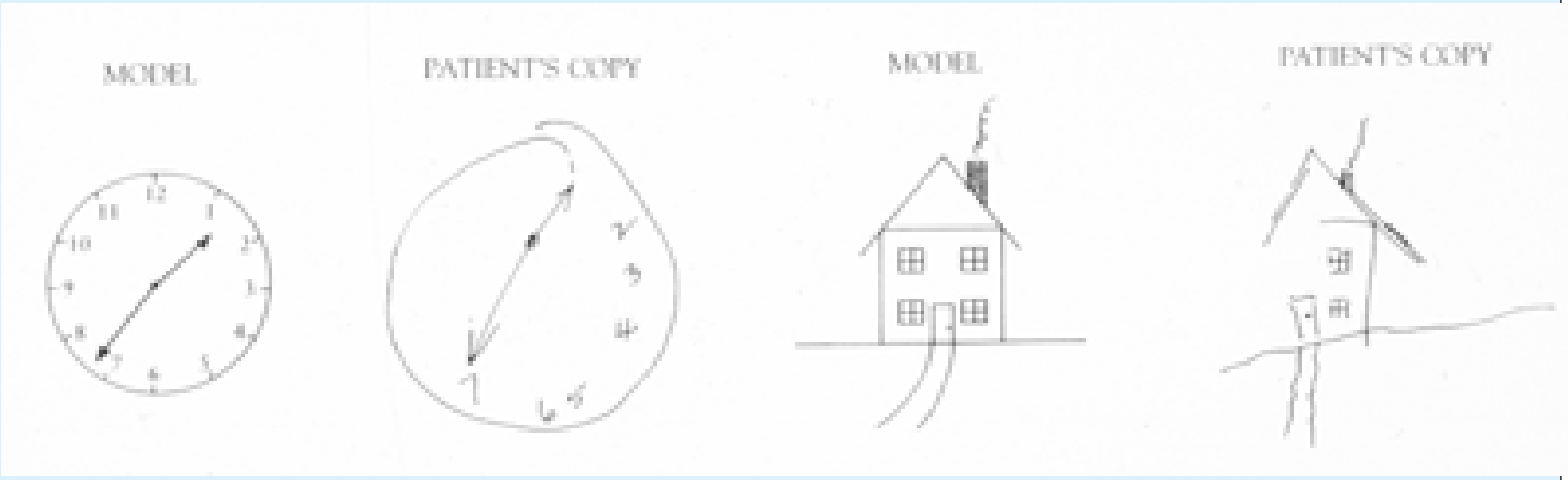
Hemispatial Neglect

- **Hemispatial neglect - a failure to report, respond or orient to stimuli presented contralateral to the side of a brain lesion in the absence of elementary motor or sensory deficits.**
- **Anosognosia - lack of awareness or denial of any problem**
- **Anosodiaphoria - awareness of deficit but without appropriate concern.**

Hemispatial Neglect

- **Incidence of neglect -**
- **Hecaen and Angelergues (1963) 415 unselected cases, clear neglect in 14%.**
- **Of those 14% with clear neglect**
  - **86% right hemi damage**
  - **7% left hemi damage**
  - **7% bilateral damage.**

Hemispatial Neglect



Alien hand syndrome

- **Inability to control one hand**
- **Hand can perform complex motor behaviors (like buttoning a shirt)**

Phantom limbs

- **Length of phantom limb may change**
- **Up to 80% feel phantom pain**

Phantom limbs

Can occur with…

- **Amputees**
- **Spinal chord injuries**
- **Congenital limb absence**

Treatment of Cramped Phantom Limbs

Phantom limbs are "stuck" and cramped

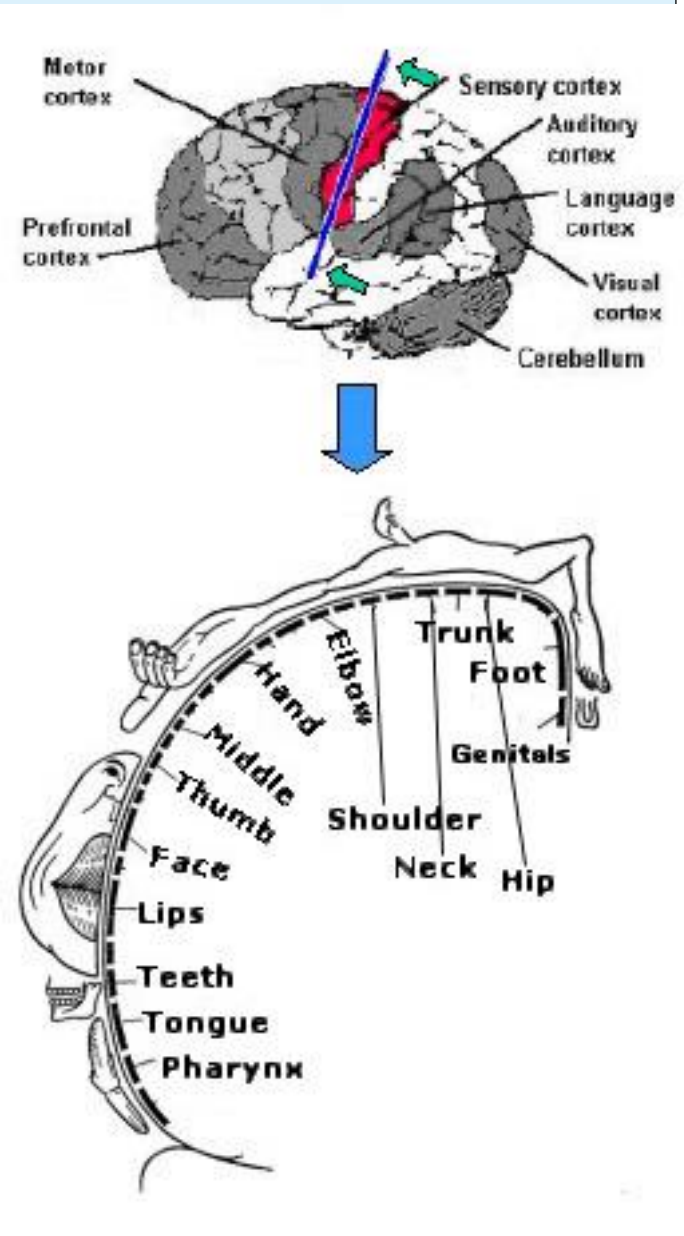
Virtual reality box

- **Normal arm in one slot**
- **Mirror image is superimposed where phantom arm would be**
- **Move real arm until matches position of phantom limb**
- **Close their eyes and make symmetric movements then open eyes**
- **4/5 subjects with involuntary clenching spasms found relief**
- **Temperature did not transfer (control for confabulation)**

Figure 1. The mirror-box. A mirror is placed vertically in the centre of a wooden or cardboard box whose top and front surfaces have been removed. The patient places his normal hand on one side and looks into the mirror. This creates the illusion that the phantom hand has been resurrected.

Cortical Reorganization

- **Thumb is lost due to accident**
- **Stimuli on face can feel like it is on phantom 'thumb'**



Explicit Memory Neural Architecture

- Related to "Hippocampal formation (HF)" in medial temporal lobe can cause of explicit memory deficits
- Korsakoff's syndrome damages mammillary bodies with alcohol abuse
- Amnesics have deficits in explicit memory

Amnesia

- Retrograde: Can't remember things in past
  - Go on trip to mars for 1 year (return trip was 1 month)
  - Hit head on capsule when landing in ocean
  - Temporally graded (events just before accident are forgotten)
    - (e.g.Forget return trip but remember being on mars)

Why is Amnesia temporally graded?

- HF holds info for a while and "teaches" information to rest of cortex
- This "teaching" is part of consolidation
- After new info has been "taught", then it is stored in rest of cortex
  - Time on mars has already been "taught" (OK!)
  - Return trip not completely "taught" yet (GONE!)

Amnesia

- Anterograde: New information cannot be learned
  - H.M cannot learn new information (e.g. who doctor "X" is)

Neuroscience Approach
Deficits of Vision

Agnosia
- Apperceptive
- Associative

Prosopagnosia
- Fusiform Face Area
- Coding for face cells
- Specificity coding (grandmother cells)
- Distributed coding

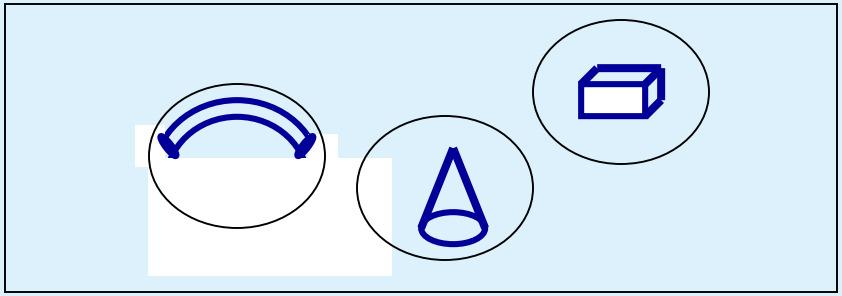
Neuroscience Approach
Neural Coding

Neural Synchrony

- Question: How does shape and color get ‘bound’ together
- Simple: Firing together at same time
- Complex: Firing in similar patterns
- May be responsible for much more than binding of perception
  - Memory?
  - Consciousness?

Neuroscience Approach
Neural Coding of Object Shape

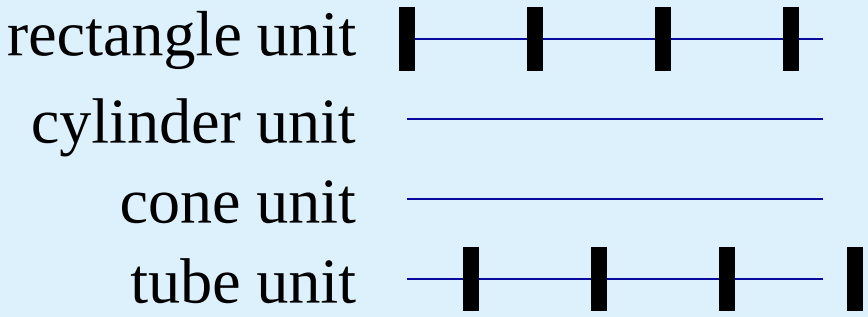
mental representation of geons

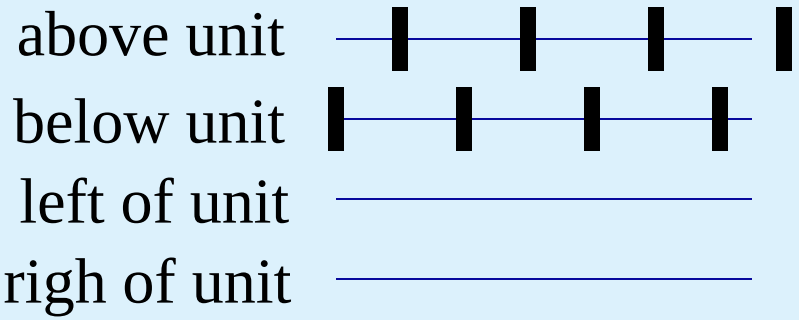


view-point invariant

what processing

where processing

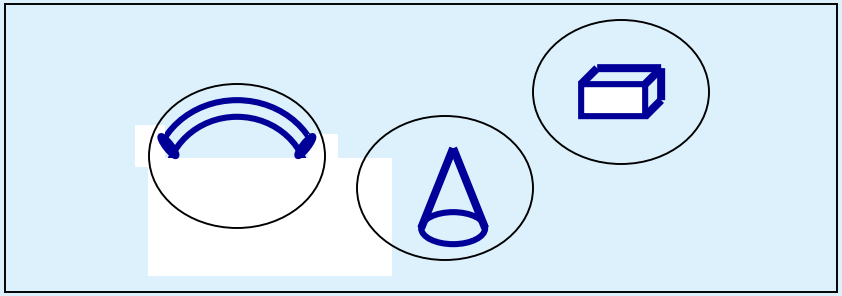




temporal binding

Neuroscience Approach
Neural Coding of Object Shape

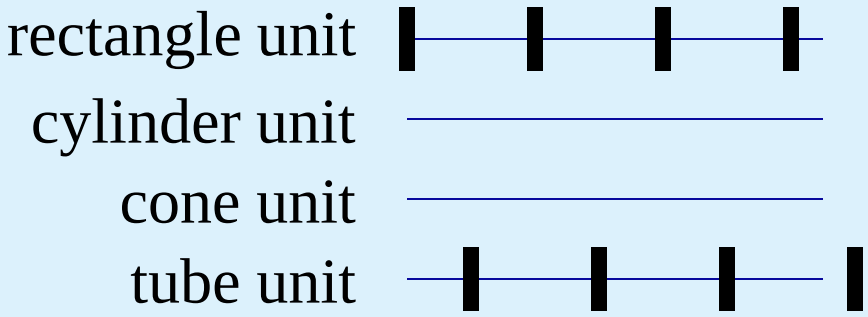
mental representation of geons

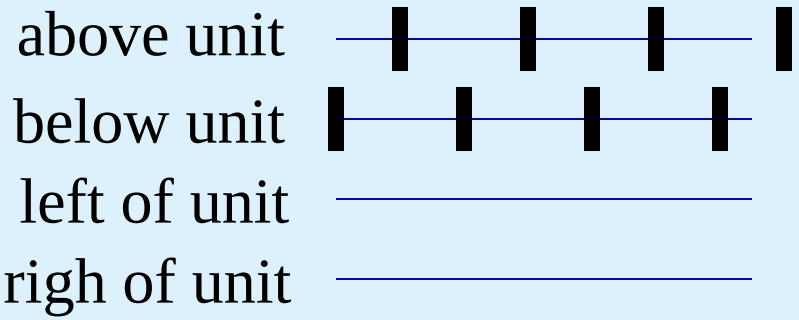


view-point invariant

what processing

where processing





temporal binding