

Brain parts

PSY 200
Greg Francis
Lecture 02

What's the deal with left and right brains?

Purdue University

1

The brain

- The source of cognition (consider transplant!)
- Weighs about 3 pounds
- Damage to some parts result in immediate death or disability
- Damage to other parts seems to have no effect!
- What brain parts are important to cognition?
- How do we discover the role of each brain part?

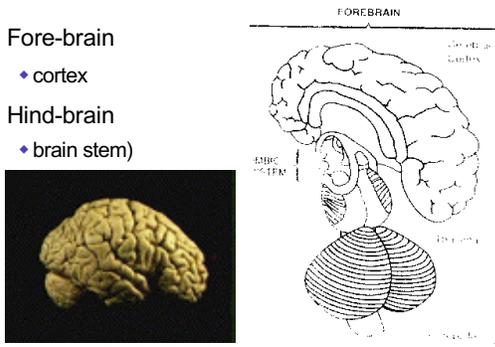


Purdue University

2

The brain

- Fore-brain
 - ♦ cortex
- Hind-brain
 - ♦ brain stem

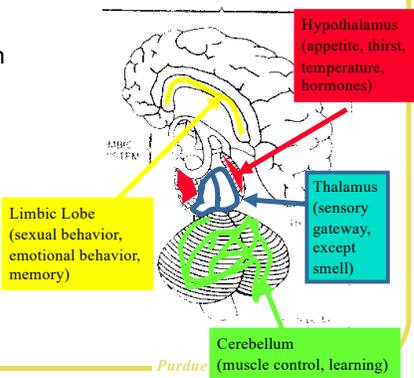


Purdue University

3

The brain

- Hind-brain
 - ♦ (brain stem)



Purdue University

4

Fore-brain

- Cortex
- Similar to a thick, crumpled newspaper page
- Grooves (fissures or sulci) separate regions



Purdue University

5

Fore-brain

- Cortex
- Similar to a thick, crumpled newspaper page
- Grooves (fissures or sulci) separate regions



Purdue University

6

Fore-brain

- Cortex
- Similar to a thick, crumpled newspaper page
- Grooves (fissures or sulci) separate regions



Purdue University

7

Fore-brain

- Cortex
- Similar to a thick, crumpled newspaper page
- Grooves (fissures or sulci) separate regions



Purdue University

8

Contralateral processing

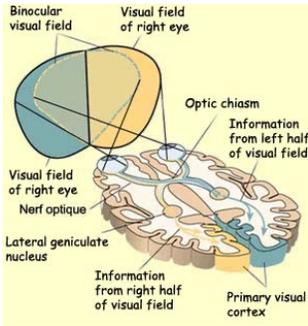
- Processing in the brain is done on the opposite side of your organs
- Control of your *right* arm is from the *left* side of your brain
- Information from your *left* field of view goes to the *right* side of your brain

Purdue University

9

Contralateral processing

- Neural fibers from the eye cross on way to cortex



Purdue University

10

Contralateral processing

- Brain hemispheres are connected by a mass of neural fibers called the *corpus callosum*

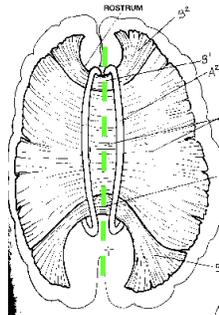


Purdue University

11

Cut corpus callosum

- Behavior changes very little
- Subtle effects



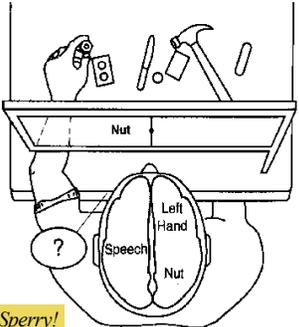
<http://www.youtube.com/watch?v=ZMLzP1VCANo>

Purdue University

12

Brain sides

- If “nut” flashes on left screen
 - subject cannot name it
 - subject can pick up nut with left hand
- If “nut” flashes on right side
 - subject can name it
 - subject cannot pick up nut with left hand until he says “nut” out loud



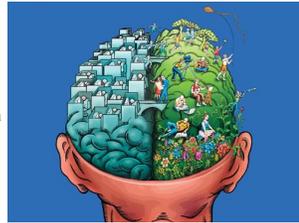
1981 Nobel Prize for Roger Sperry!

Purdue University

13

Brain sides

- Results led to further study and common belief that
 - Left side: language, analytical, classification, Western rationalization
 - Right side: art, music, recognition of faces and shapes, Eastern mysticism
- Vast oversimplification
 - in a normal brain, both sides are involved in many tasks
- Results *do* support the idea that different parts of the brain are involved in different cognitive tasks (*modularity hypothesis*)

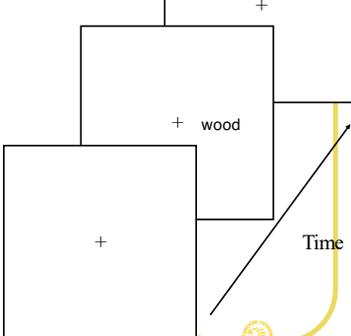


Purdue University

14

CogLab

- In the CogLab experiment *Brain asymmetry*
- You stared at a central fixation point
- A word was presented to either the left or right side of fixation

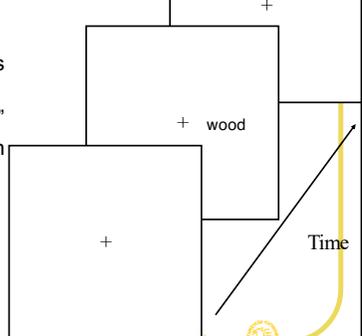


Purdue University

15

CogLab

- Your task was to judge whether the presented word was “old” (seen on an earlier trial) or “new” (not previously seen in this experiment)

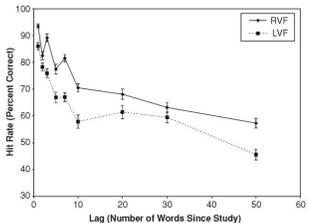


Purdue University

16

CogLab

- Federmeier & Benjamin (2005) found better memory performance for words presented in the right visual field
- Words in the right visual field go to the left hemisphere
 - Which is known to be specialized for language



Lag (Number of Words Since Study)	RVF Hit Rate (%)	LVF Hit Rate (%)
0	95	85
5	90	80
10	85	75
15	80	70
20	75	65
25	70	60
30	65	55
35	60	50
40	55	45
45	50	40
50	45	35

Purdue University

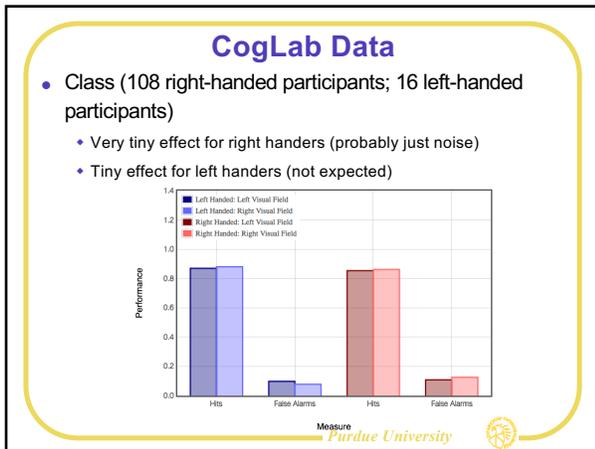
17

CogLab

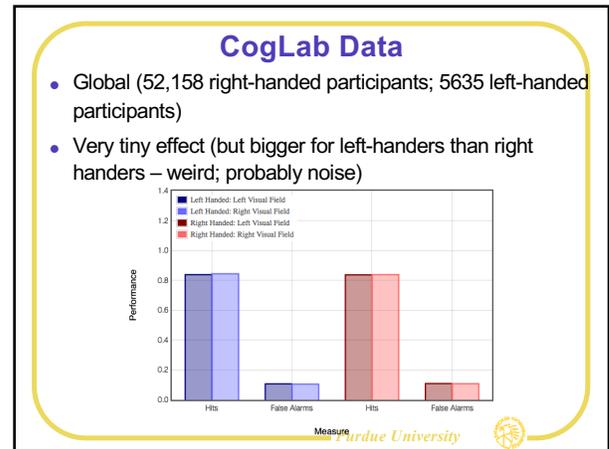
- Other explanations than hemispheric specialization
 - Reading goes from left to right, from fixation to right visual field
 - Perceptual advantage to right visual field?
 - Attentional advantage to right visual field?
- It is difficult to come up with an experiment that isolates hemispheric specialization

Purdue University

18



19



20

Anatomy

- The cortex contains large fissures that separate five major areas
 - ♦ Limbic (already discussed)
 - ♦ Occipital
 - ♦ Parietal
 - ♦ Temporal
 - ♦ Frontal
- Each has distinct properties

21

Occipital lobe

- Receives information from the eye
 - ♦ Most investigated area of the brain

22

Parietal lobe

- Sensations of pain, temperature, touch, pressure

23

Parietal lobe

- Primary sensory area
 - ♦ sensitivity involves disproportionate areas of the brain, relative to size of body part

24

Temporal lobe

- Hearing
 - ♦ speech (left)
 - ♦ music (right)
- Memory and attention
 - ♦ visual recognition

Purdue University

25

Frontal lobe

- Largest part of cortex
 - ♦ planning
 - ♦ prediction
 - ♦ motor area
 - ♦ speech area

Purdue University

26

Brodmann areas

- Divide lobes into areas
- e.g. Brodmann
 - ♦ Area 1, Area 12, ... Area 200
 - ♦ Some special names: V1, V2, V3,...

Purdue University

27

Area function

- Can partly identify function by looking at nerves coming in and out of area
- Pathways through areas seem to be involved in different kinds of cognitive tasks

Purdue University

28

Brain layers

- There is order and function even within an area
- The cortex is a *sheet* of neurons
- In its thickness are 6 layers of neurons
 - ♦ numbered 1-6
 - ♦ sometimes include subdivisions (4a, 4b, 4ca, 4cb, ...)

Purdue University

29

Conclusions

- Lots of research in this area
- New brain regions are being mapped out daily with ever increasing resolution
- Cognitive neuroscience relies strongly on the “modularity hypothesis”
- Putting everything together is very difficult

Purdue University

30

Next time

- Brain scans
- EEG recordings
- MRI scans
- Functional MRI

- *How to study the brain without killing someone.*

Purdue University 

31