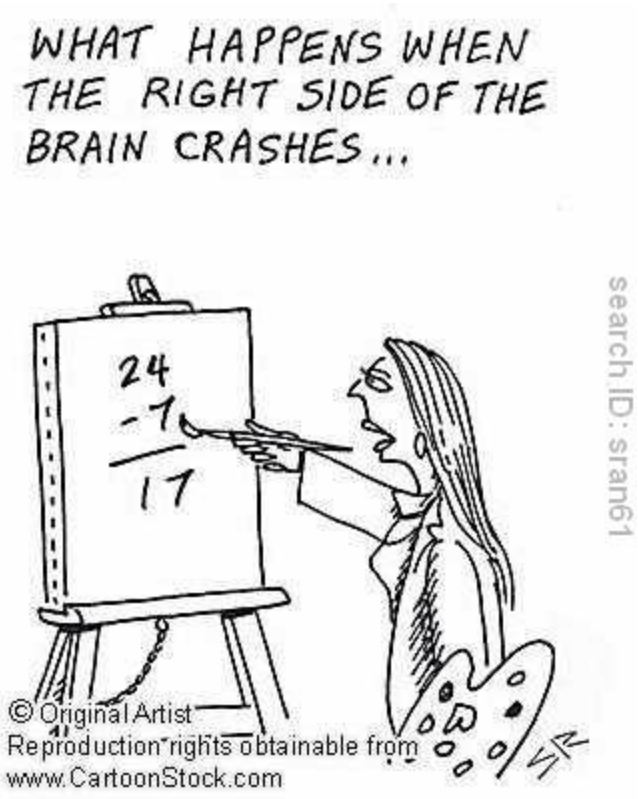
The Brain: Hemispheres

Introduction to Cognitive Science

“Left-Brained” People vs “Right-Brained” People

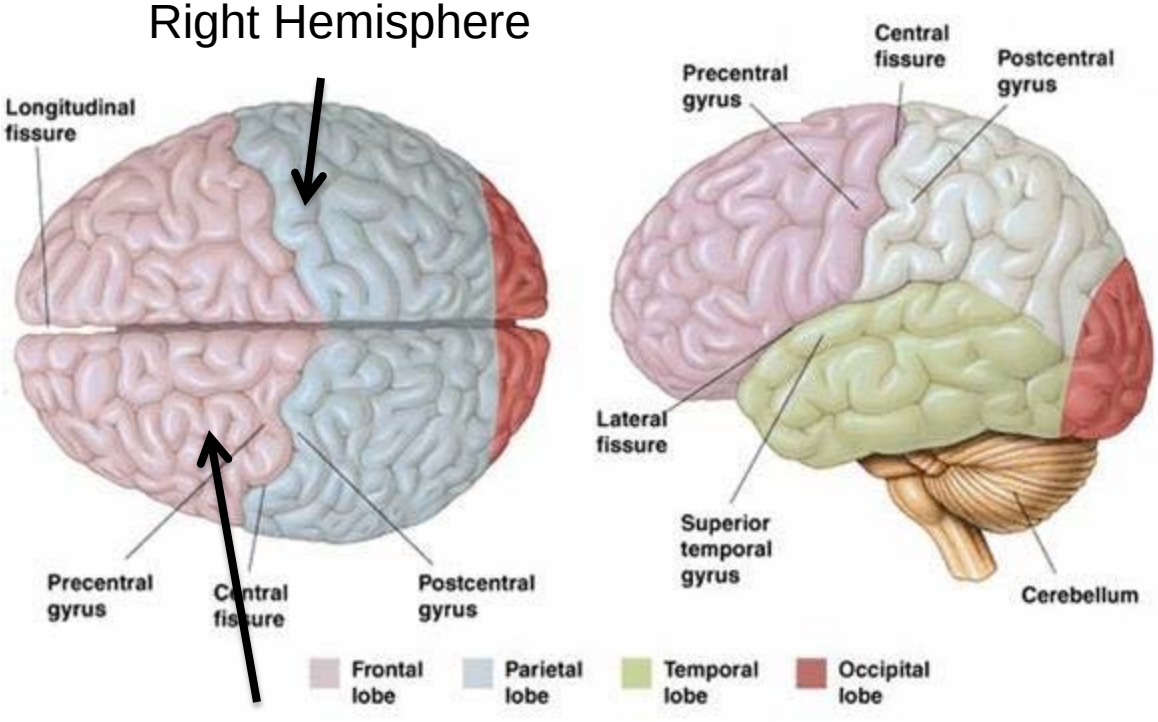
Left-Brained	Right-Brained
Analytical	Synthesizing
Rational	Intuitive
Linear / sequential	Simultaneous
Detailed	Holistic / whole picture
Rules	Associations
‘Sciency’	‘Artsy’



How much of this is true?

The Two Hemispheres

Right Hemisphere



Left Hemisphere

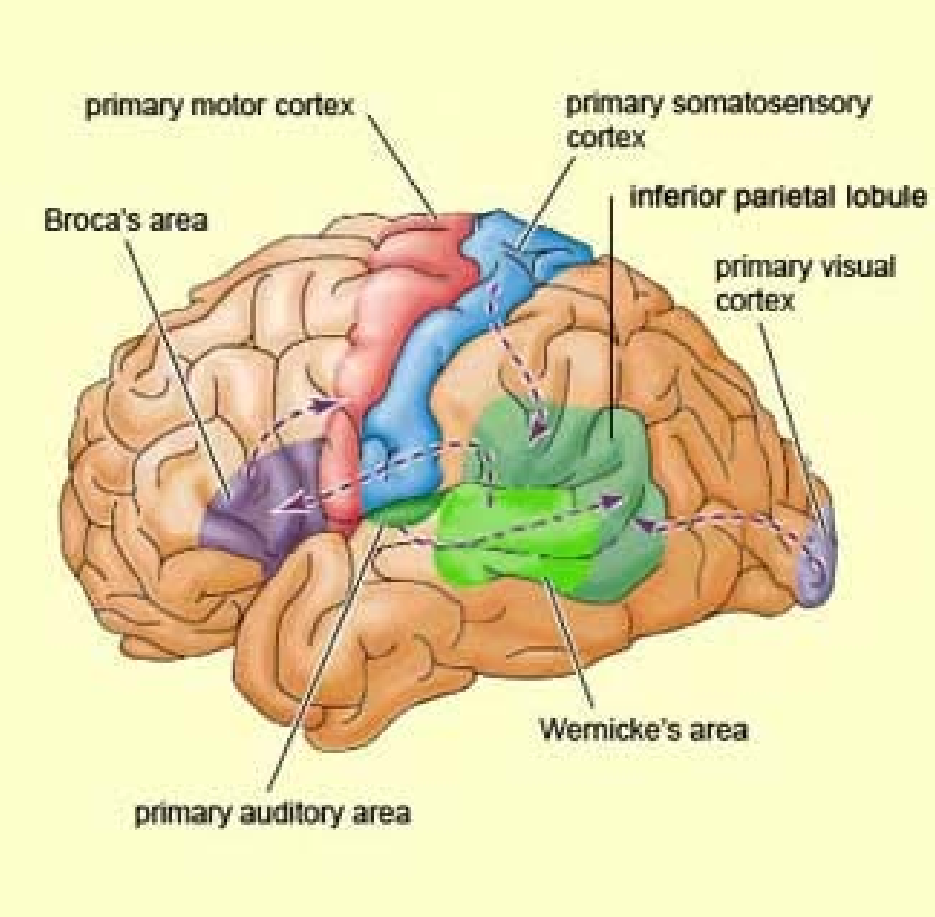
The hemispheres Communicate via the Corpus Callosum

People use both hemispheres

Lateralization

- When a certain cognitive function is processed in one of the hemispheres, as opposed to the other, then that cognitive function is lateralized.
- A clear example of laterilization:
  - Left brain takes care of sensory-motor functions of right half of body
  - Right brain takes care of sensory-motor functions of left half of body
- Does left-handedness vs right-handedness correlate with ‘right-brained’ vs ‘left-brained’?
- What about eye dominance?
- Any other clear lateralization?

Language



Wernicke's Area:
Speech Understanding

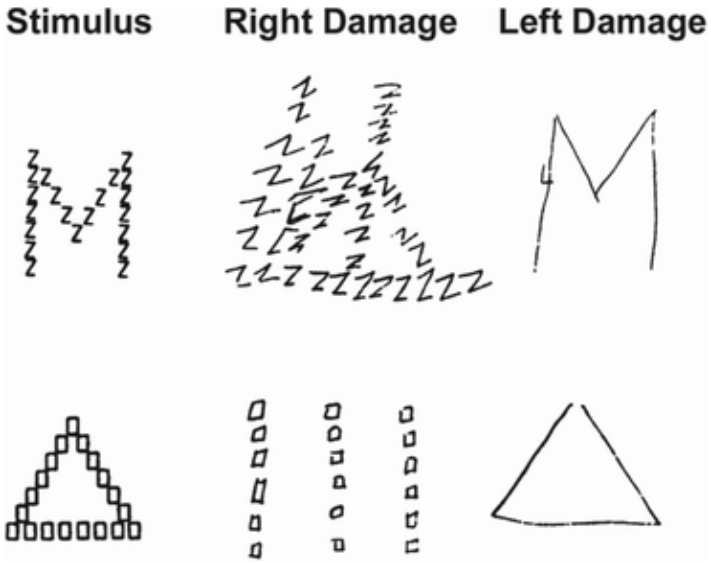
Broca's Area:
Speech Production

In 95% of right-handed people, the language is predominantly processed on the left

In 20% of left-handed people, It's on the right, and for another 20% it's bilateral
(so for most, it's still on the left)

Detailed vs Holistic Processing

- The left hemisphere seems to process information with an eye for detail
- The right hemisphere seems to process information with an eye for the bigger picture



• Navigation: People with right-brain damage have to navigate their environment with explicit ‘scripts’ based on detailed landmarks.
• Face recognition: People with damaged right brain have to ‘piece together’ who is in front of them based on facial features.
• Right brain has more white matter, as axons of neurons are longer in right brain

The ‘Rational’ Left vs the ‘Impulsive’/’Intuitive’ Right

- Much of what the right brain is doing is unconscious (or at least difficult to express in words: connection between consciousness and language?). As such, decisions or judgments made by the right brain are the kind of decisions we often call ‘hunches’ or ‘impulses’.
- On the other hand, the decisions made by the left brain are the kind of planned out, consciously deliberated (or at least, expressed in words), decisions.
- Note the immediate stygma we attach to both kinds of decisions: Rational = good (objective), Impulsive = bad (subjective)
  - But there are many cases where ‘impulsive’ decisions are actually perfectly good decisions (‘Blink’ is a nice popular-science book on this)
  - And many cases where ‘reasoned out’ decisions are bad ones -> ‘rationalization’

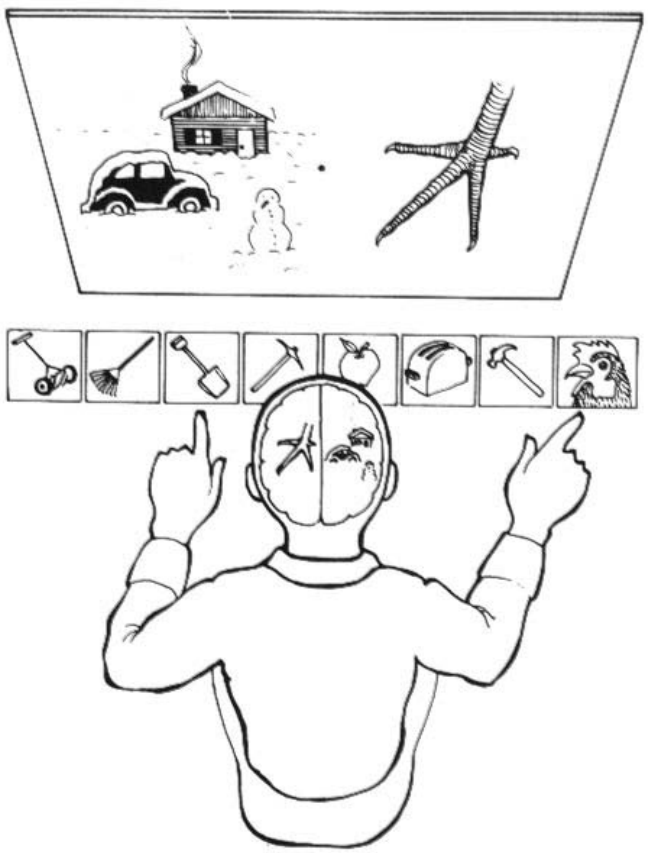
The Two Hemispheres as a Team

- The resulting picture thus seems to be that while there is no clear lateralization of cognitive functions, the two hemispheres do seem to have subtle differences in their ‘style’ of processing.
- Indeed, it is probably often by pooling together the strengths/findings of the two hemispheres that we accomplish cognitive tasks.

When the Team Members get Separated: Split-Brain Patients

- In split-brain patients, the two hemispheres are not communicating (often because the corpus callossum, for medical reasons, has been surgically severed)
- A typical split-brain patient can verbally report what is in their right visual field (-> left brain -> language), but not what is in their left visual field.
- Still, information from the left visual field can be processed:
  - Experiment: A split-brain patient was shown picture of a spoon in left visual field. When asked what she saw, patient said “Nothing”. Patient then had to reach with left hand behind a curtain, and pick one of the objects there: book, pen, spoon, etc. Patient picked the spoon. When asked what she had in her hand, she said “pencil”

Another Split-Brain Experiment



Subjects are asked to point to what they are seeing.
Left hand points to shovel, right to chicken
Explanation: Snowy scene in left visual field is registered by right hemisphere, which controls left hand, and vice versa

Subjects are then asked to explain why they made that choice
They say: Well, I see a chicken foot, so I point to the chicken, and the chicken poop needs to be shoveled!
Explanation: with language in left hemisphere, they can only report on what's on the right. And while the shovel initially doesn't fit in, the patient quickly comes up with a story, i.e. rationalizes, why he picked the shovel.

Video

Split Brain -> Two Minds? Two Personalities?

One side of face mirrored

Other side of face mirrored

Atheist or Believer?

Alien Hands: Another case of Non-Communication

- Some people suffer from alien hands (often the left one: ‘sinistra’ = left): it does things without them being in control of what it does.
- In fact, the alien hands often negates what the other hand just did (e.g. left hand will unbutton the shirt that the right hand just buttoned) as if it is the expression of some ‘evil twin’ inside them.
- Is this why most people are right-handed?
- Is this why ‘right’ also means ‘correct’?