Brain and Behavior
Lecture 13

V. BRAIN AND BEHAVIOR
A. How we Know About the Brain

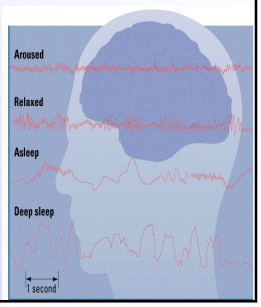
- Technology has improved our ability to know how the brain works.
- **Case Study (Phineas Gage)**
  - Gage was a railroad construction foreman. An 1848 explosion forced a steel rod through his head.
  - Others said he was "…no longer Gage…" Impulse control was difficult and he was emotional. Lost his job, worked as a sideshow exhibit.

V. BRAIN AND BEHAVIOR
A. How we Know About the Brain
EEG (Electroencephalogram)

The EEG records the brain's electrical activity.

The pattern of activity changes with arousal level: when relaxed, EEGs have slow waves, when excited EEGs has fast waves.

The EEG is used to record brain activity for sleep research and to diagnosis brain disorders.

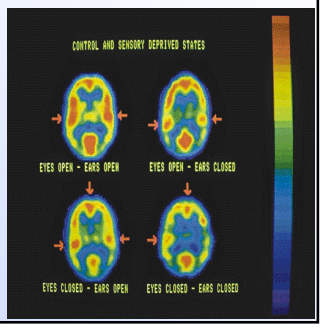


V. BRAIN AND BEHAVIOR
A. How we Know About the Brain
PET (Positron Emission Tomography)

Small radioactive isotopes are placed in the blood

Sensors detect radioactivity. Different tasks show distinct activity patterns

Figures depict active areas which have increased blood flow



V. BRAIN AND BEHAVIOR

A. How we Know About the Brain

MRI (Magnetic Resonance Imaging)

Magnetic fields align certain ions and compounds.

When field is removed, the molecules release energy as radio waves and a computer calculates tissue density providing a 3D image.

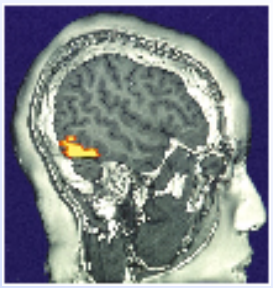
V. BRAIN AND BEHAVIOR

A. How we Know About the Brain

fMRI (Functional Magnetic Resonance Imaging)

fMRI provides dynamic, not just static, information.

- The fMRI scan shows the visual cortex activated as the subject looks at faces



V. BRAIN AND BEHAVIOR

B. The Left and Right Hemispheres

- The nature and functions of the Left and Right hemispheres are different.
  - This is known from the study of people with language disorders and split brain
- **1. Language Disorders**
- **Aphasia** (Greek: Lack of Speech): Primary difficulty with the production of speech.
  - **Expressive (Broca's) aphasia:** Unable to utter or write a word.
  - But, there is no paralysis of speech muscles (move lips and tongue)

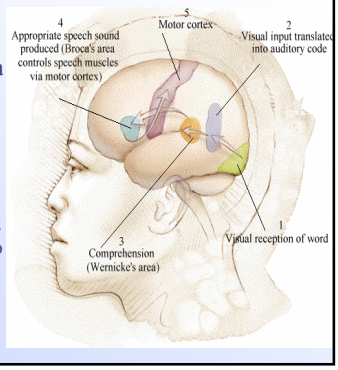
V. BRAIN AND BEHAVIOR

B. The Left and Right Hemispheres

Damage to the left frontal lobe region called **Broca's Area** which is next to motor projection zone that controls speech muscles.

Impairment of the ability to organize & plan movements into a unified sequence

Understand what is being heard but cannot answer

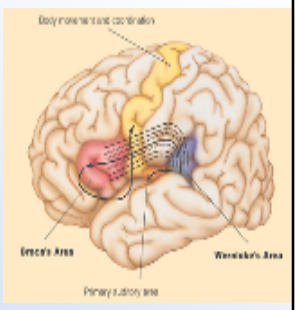


V. BRAIN AND BEHAVIOR
B. The Left and Right Hemispheres

Receptive (Wernicke's) Aphasia: Don't understand when being spoken to.

Talk freely and fast but in word salads which are grammatical sentences without meaning.

Problem in the left hemisphere area called **Wernicke's Area**, which is near the auditory cortex.



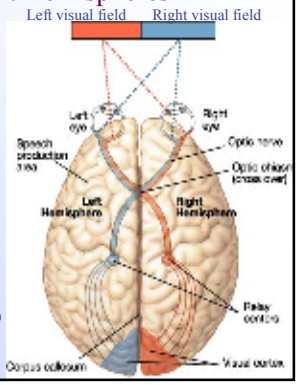
V. BRAIN AND BEHAVIOR
B. The Left and Right Hemispheres

2. Spilt brain

Each hemisphere receives information about the opposite side of the visual field.

Information from the left visual field, goes to right hemisphere and info from the right visual field goes to the left hemisphere.

Normally CC sends info to the left and right hemispheres.

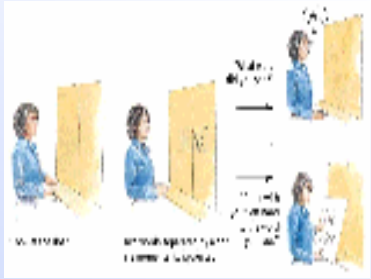


V. BRAIN AND BEHAVIOR
B. The Left and Right Hemispheres

For patients with their CC severed seeing HE•ART…

HE goes only to the right hemisphere, and can be pointed at, but not read.

ART appears to the left hemisphere and can be read, but not pointed at.

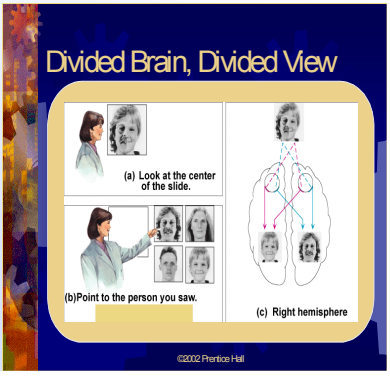


V. BRAIN AND BEHAVIOR
B. The Left and Right Hemispheres

Severing the Corpus Callosum shows…

Sequentially-based language processing is only on the left hemisphere

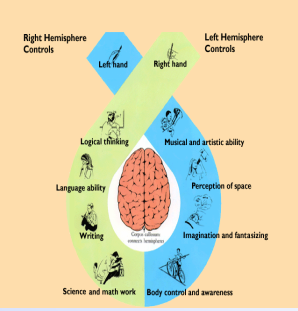
Holistically-based face recognition is only on the right hemisphere



V. BRAIN AND BEHAVIOR
B. The Left and Right Hemispheres

Split brain research suggests a lateralization of function in the hemispheres.

In the normal brain, more *sequential* processing occurs in left hemisphere (language, math, fine motor control); More *holistic* processing in right hemisphere (space, form, and face processing)



Not logic vs. creativity.

Warning: Right handers only!

V. BRAIN AND BEHAVIOR
B. The Left and Right Hemispheres

- **For Right-Handers:**
  - The **Left hemisphere** is the dominant side. Brain damage (lesions) on the left hemisphere for right-handers may knock out sequential coordination (language, fine motor control**). Left brain is NOT LOGIC**
  - Lesion to the **right hemisphere** affects reasoning about overall patterns (space, form, recognizing faces). **Right brain is NOT CREATIVITY**

V. BRAIN AND BEHAVIOR
B. The Left and Right Hemispheres

- **For the 12% Left Handers**:
  - More ambiguous results.
  - For 50% of the lefties, speech is localized in the left hemisphere
  - For the other 50%, speech is localized in both hemispheres.
- Less lateralization of hemispheric function in left-handed people.

V. BRAIN AND BEHAVIOR
C. Brain Development and Plasticity

- The brain is always changing.
  - General and dedicated mechanisms of brain change, beyond injury or neural death.
    - General mechanism depends on experience – like learning or conditioning.
      - Makes new connections between neurons
    - Dedicated mechanism is biologically controlled, but is experience-expectant.
      - Also makes new connections which are "wired" into the brain (sounds of your first language)
- Brain Plasticity
  - Children better adapt to brain injury or insult than adults because children's brains are still forming.

V. BRAIN AND BEHAVIOR
D. Research Issues

- To really understand the biological approach, you must give up all hope of understanding behavior in terms of folk psychology.
  - Thinking of the mind as a biochemical machine means that there can be no talk of beliefs or desires.
  - Brains works because of transmission of neural impulses and release of neurotransmitters, not because of hopes, wishes, desires or beliefs.
  - Consider dreams which we explain as unconscious wishes. But this is folk psychology. Is there another way?

V. BRAIN AND BEHAVIOR
D. Research Issues

- **1. Dreams and Dreaming**
  - Dreaming doesn't occur all the time, only during a special time of sleep.
  - **Rapid Eye Movement (REM) Sleep**: Sleep periods characterized by fast eye movement behind closed eyelids, loss of muscle tone, and dreaming.
    - The brain's pattern of electrical activity (EEG) is like being awake
    - REM sleep occurs in a 90 minute cycle and may last as short as a few minutes and as long as 1 hour.

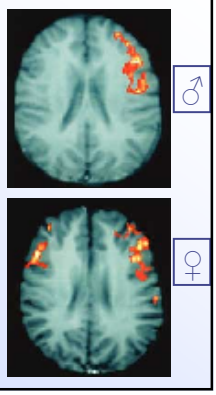
V. BRAIN AND BEHAVIOR
D. Research Issues

- The lower brain is especially active during REM sleep, even among newborns
  - Pons process basic sensations (balance, running), and these randomly activated sensations are the interpreted by higher cortical regions.
- **Activation-Synthesis Theory**: Theory that dreaming results from cortical synthesis and interpretation of neural signals triggered by activity in the lower part of the brain.
  - Dreaming may hold no insight to your wishes, but may hold insight to the manner by which you interpret your sensations.

V. BRAIN AND BEHAVIOR
D. Research Issues

2. Gender Differences

- Sex differences in the brain have been studied for many years.
  - Many findings seem to reflect cultural bias and cultural changes
- Reliable differences have been found in activity of certain brain areas during some tasks
  - Example: MRI of a language task.



V. BRAIN AND BEHAVIOR
D. Research Issues

3. Drugs

- Psychoactive drugs are chemicals that change perceptions and moods.
  - Drugs work at synapses by stimulating, inhibiting, or mimicking neurotransmitter activities
    - Stimulants (nicotine, caffine) temporarily excite neural activity and arouse body functions.
    - Depressants (alcohol and barbiturates or tranquilizers), calm neural activity and slow body functions.
    - Hallucinogens (marijuana, estcasy) distort perceptions and evoke sensory images in the absence of input.

V. BRAIN AND BEHAVIOR
D. Research Issues

3. Drugs

- Caffeine (Stimulant, Legal and Uncontrolled)
  - Inhibits adenosine leading to increased of dopamine and glutamate.
    - Increased alertness and wakefulness at the expense of anxiety, restlessness, insomnia; uncomfortable withdrawal
- Alcohol (Depressive, Legal and Controlled)
  - Slows sympathetic nervous system activity.
    - A high followed by relaxation and disinhibition but results in depression, memory loss, organ damage, impaired reactions
- Nicotine (Stimulant, Legal and Controlled)
  - Nicotine triggers the release of neurotransmitters.
    - Increase in arousal, relaxation and sense of well-being at the expense of heart disease and cancer.

V. BRAIN AND BEHAVIOR
D. Research Issues

3. Drugs

- Marijuana (Hallucinogen, Illegal, Misdemeanor)
  - Active ingredient, THC, activates receptors in the frontal lobes, limbic system, and motor cortex.
    - Enhanced sensation, relief of pain, distortion of time, relaxation but also impaired learning and memory, increased risk of psychological disorders, lung damage from smoke
- Ecstasy (Stimulant and Mild Hallucinogen, Illegal Felony)
  - MDMA releases serotonin and blocks its re-absorption
    - Emotional elevation and disinhibition but at the cost of dehydration, overheating, depressed mood, impaired cognitive and immune functioning

V. BRAIN AND BEHAVIOR
D. Research Issues

4. The Self

- Is the self a unified thing or an illusion resulting from a "loose confederation of independent modules"?

A fMRI study shows that independent modules are involved in our intuition (x sites) and evaluation (c-sites) of ourselves