

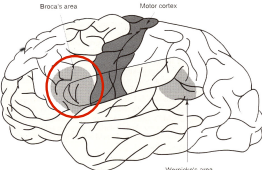
The Brain

Cerebral Specialization

Hemisphere-specific Deficits

- Language deficits
 - Associated with left hemisphere damage
 - First noticed in the 1800's
- Broca
 - Examined deficits carefully and methodically
 - Became convinced that the left hemisphere was critical for speech
- Further research localized speech centers in brain

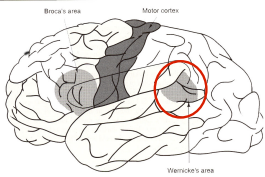
Broca's Area



The diagram shows a lateral view of the human brain. Broca's area is highlighted with a red circle in the frontal lobe. The Motor cortex is shaded in grey in the posterior frontal lobe. Wernicke's area is shaded in grey in the posterior temporal lobe. Labels with leader lines point to each of these areas.

- Broca's area
 - Speech production
- Broca's aphasia
 - Comprehension preserved
 - Impaired ability to produce grammatical sentences

Wernicke's Area



- Wernicke's area
 - Speech comprehension
- Production unaffected
 - Sentences grammatical
 - Semantic content affected
 - Jargon
 - Numerous neologisms
 - Appear unaware of speech deficit

Broca's Aphasia	Wernicke's Aphasia
<p>Speech Quality Severe impairment, marked by extreme effort speaking, hesitant utterances, short responses</p> <p>Nature of Speech Agrammatical, loss of syntactic markers and inflections, use of simple noun/verb categories</p> <p>Comprehension Relatively unimpaired compared to production. Word finding difficult might be due to production difficulties</p>	<p>Little impairment, fluent speech production, no hesitations</p> <p>Marked by invented words or semantically inappropriate substitutions, long strings of jargon</p> <p>Severely impaired, marked by lack of awareness that speech is incomprehensible comprehension also impaired in nonverbal tasks (pointing)</p>

Deficits and Specialization

- Different symptoms associated with damage to different portions of the left hemisphere
- Implications
 1. Left hemisphere responsible for language
 2. Different regions of left hemisphere associated with different aspects of language
 3. Syntax and semantics are two separable aspects of language use

Split Brain Research

- Contributed the most to determining hemispheric functions
- Sperry (1960's)
 - Work resulted in awarding of Nobel prize in 1981
- Examined hemispheric performance by severing cat corpus callosums

Corpus Callosum

- Bundle of nerve fibers
- Connect the hemispheres of the brain
- Believed to relay information between the hemispheres

Sperry Research

- Severed corpus collusum in cats
- Blindfolded one of the cat's eyes
 - Trained it on a visual problem solving task
 - Trained until cat could perform task
 - Was training a specific hemisphere

Sperry Results

- Trained eye blindfolded during testing
- Memory of task stored in the hemisphere receiving the visual information
 - Hemispheres no longer communicated
 - Cat could no longer perform task

Epilepsy Patients

- Provided further evidence for corpus callosum's function and hemispheric specialization
- Corpus callosum severed in patients with severe, life-threatening forms of epilepsy

Epilepsy Patients

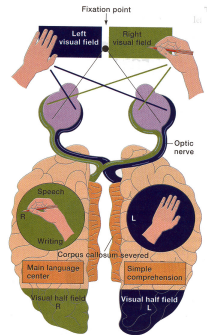
- Severing corpus callosum prevents hemispheres from communicating
- Results in a patient with "two minds"
- Appear normal in most situations
 - Exceptions
- Takes specialized tests to identify effects of the operation

Testing Split-brained Patients

- Object identification
- Hold object in left hand
 - Are unable to describe the object
 - Right brain possesses limited capacity for speech
 - Can correctly point at the object with right hand
- Nonverbal tests of knowledge needed

Testing Split-brained Patients

- Visual tests
- Each eye sends information to each hemisphere
 - Need to present image to right or left half of visual field to send it to just one hemisphere
 - Chimeric images



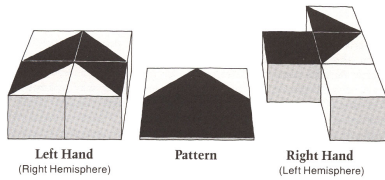
Visual Tests

- Asked to describe the face seen
 - Patient will describe image presented in the right visual field
- Asked to point to face seen
 - Patient will point to image presented in the left visual field
- Unaware of discrepant information



Spatial Tests

- Block pattern completion
- Left hand does well
- Right hand does poorly



Hemispheric Specialization

- Hemispheres of the brain do serve specific functions
 - Right brain excels at spatial processing
 - Left brain excels at verbal processing
- Exceptions do occur

- Right Brain = creative thinking
- Left Brain – logical, rational thinking
 - Simplification of Sperry's research
- No support for proposal of hemispheric dominance of complex tasks
 - Complex thought typically involves both hemispheres

Localization of Brain Function

- Complex cognitive processes
 - Involve both hemispheres
 - Involve many areas of the brain
- Localization
 - Left = language, right = spatial
 - General rule. Not a constant
- Brain “maps” are an approximation
 - Individual differences
