

Chapter 14: Human Communication



Note REVISED reading list on
website



Verbal Behaviors

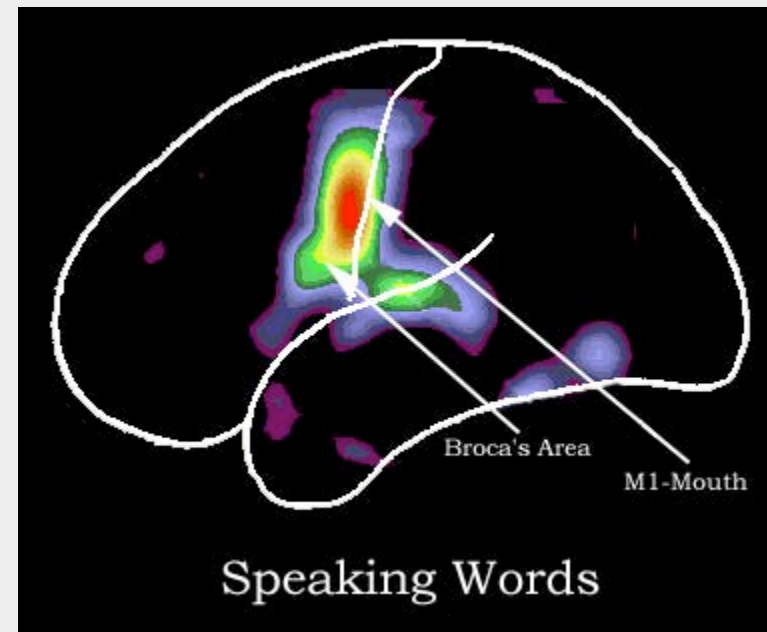
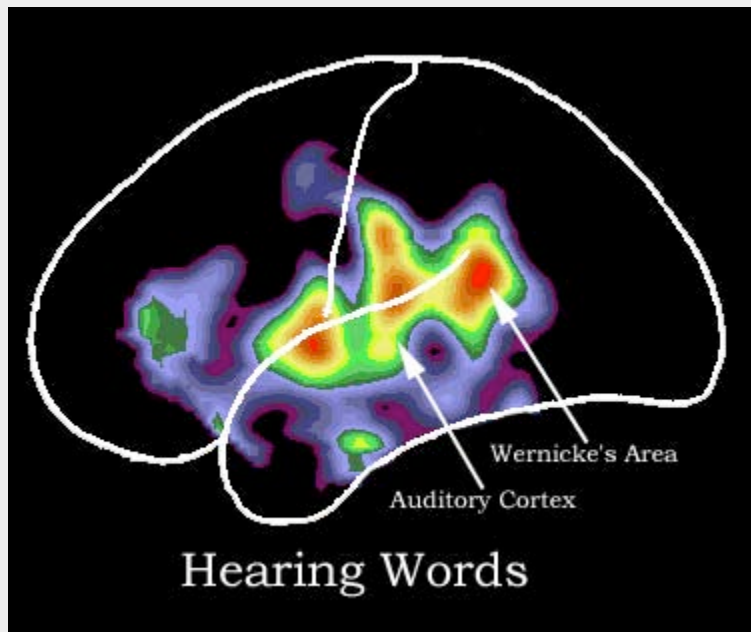
Verbal behaviors include

- Talking
- Understanding speech
- Reading
- Writing

Verbal communication allows for social interaction and underlies the accumulation of knowledge from one generation to the next

The Neurology of Language

- Our understanding of the brain regions that are involved in language comes from studies of
 - Stroke victims
 - Persons with seizure disorders that required brain surgery
 - Normal persons using brain imaging (PET or fMRI)



Verbal behaviors are lateralized

the left hemisphere is dominant for language in most people

- the Wada test can be used to determine hemispheric dominance for language



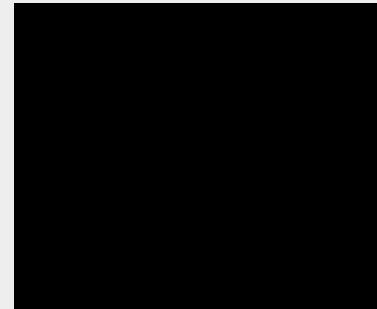
Sodium Amytal injected into right or left carotid artery, putting that half of the brain asleep. Then test opposite side for language.

The right hemisphere plays a role in the expression and recognition of emotion in the tone of voice as well as in prosody (rhythm and stress of speech)

Speech Disorders

Aphasia

- Disturbance in speech
 - Production
 - Comprehension
- Aphasia is not the result of
 - Lack of motivation
 - Sensory/motor deficit (e.g paralysis)



Aphasia can result from damage to the left hemisphere

Broca's Aphasia

- Broca's aphasia results from damage to the inferior left frontal lobe
- Characteristics of Broca's aphasia include
 - Slow, laborious speech
 - Spoken words have meaning (are intelligible)
 - Person can comprehend the speech of others
 - Difficulty with function words (a, the, in, about)
- Three major speech difficulties are evident in Broca's aphasia
 - **Agrammatism**: difficulty in using grammar rules (e.g. -ed)
 - **Anomia**: difficulty in finding appropriate words
 - Difficulty with word articulation

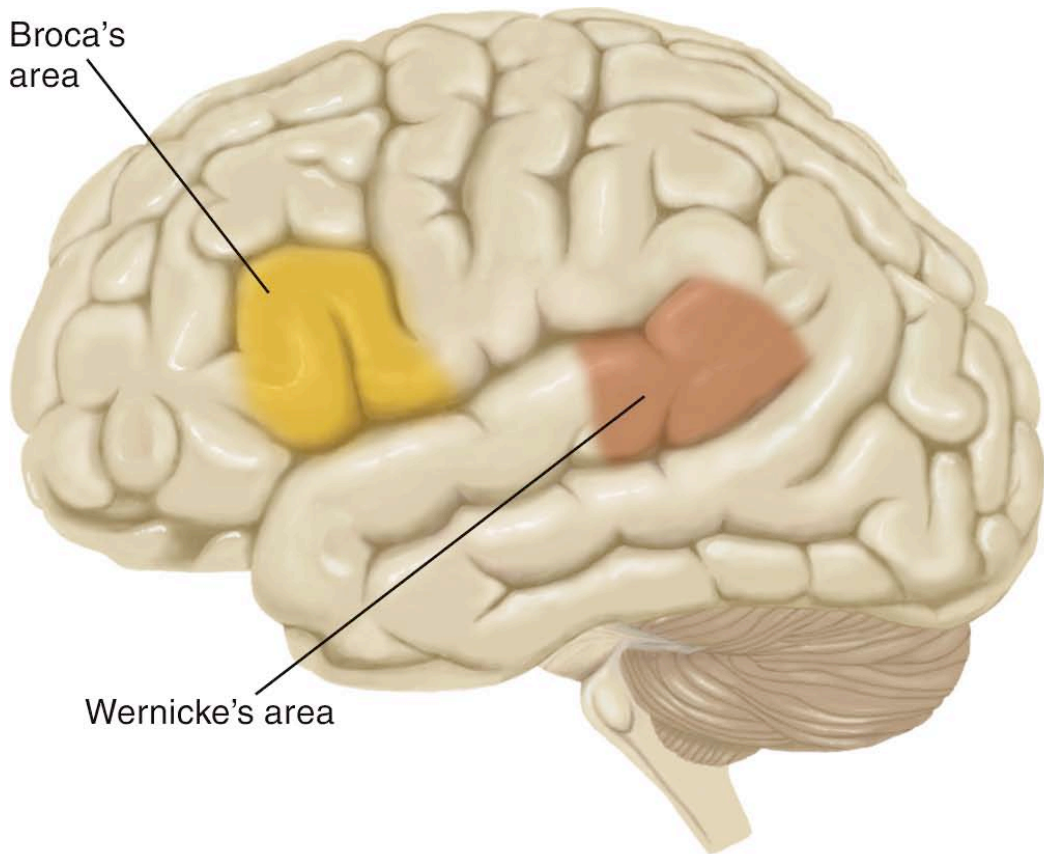
Brain Regions Involved in Speech Production/Comprehension

Speech Production:

Broca's area

Speech Comprehension:

Wernicke's area



Wernicke's Aphasia

- Speech comprehension involves the auditory system as well as neural circuits in the superior left temporal gyrus (Wernicke's area)
- Word recognition is disrupted by damage to Wernicke's area
- The primary symptoms of Wernicke's aphasia are
 - **Poor speech comprehension**
 - Evident in non-verbal tasks ("point to object...")
 - Cannot repeat statements made by others
 - **Fluent, but meaningless speech**
 - Patients can use content words, appropriate grammar
 - Patients are unaware of comprehension deficit

Wernicke's Aphasia

- Wernicke's aphasia consists of distinct deficits
- Recognition of spoken words
 - **Pure word deafness**: disruption of inputs to Wernicke's area results in an inability to understand speech
- Comprehension of word meaning
 - **Transcortical sensory aphasia**: damage to posterior language area
 - Person can repeat statements, but does not comprehend the statements
 - Suggests distinction between speech recognition/comprehension
- Conversion of thoughts into words

Conduction Aphasia

- Information about word sounds is carried via the *arcuate fasciculus*
 - connects Wernicke's area with Broca's area
- Damage to the fasciculus produces conduction aphasia:
 - Fluent, meaningful speech
 - Good word comprehension
 - Difficulty in repeating words

Overview of Aphasia

Broca's area

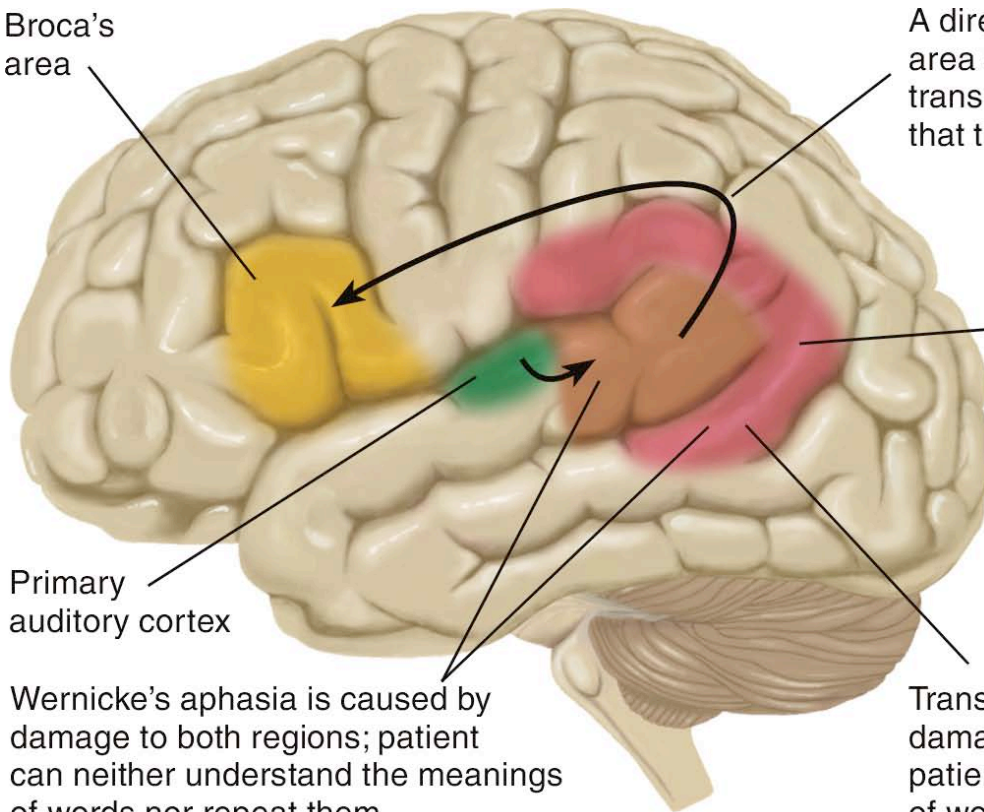
A direct connection between Wernicke's area and Broca's area enables patients with transcortical sensory aphasia to repeat words that they cannot understand

Posterior language area

Primary auditory cortex

Wernicke's aphasia is caused by damage to both regions; patient can neither understand the meanings of words nor repeat them

Transcortical sensory aphasia is caused by damage to the posterior language area; patient cannot understand the meanings of words but can repeat them



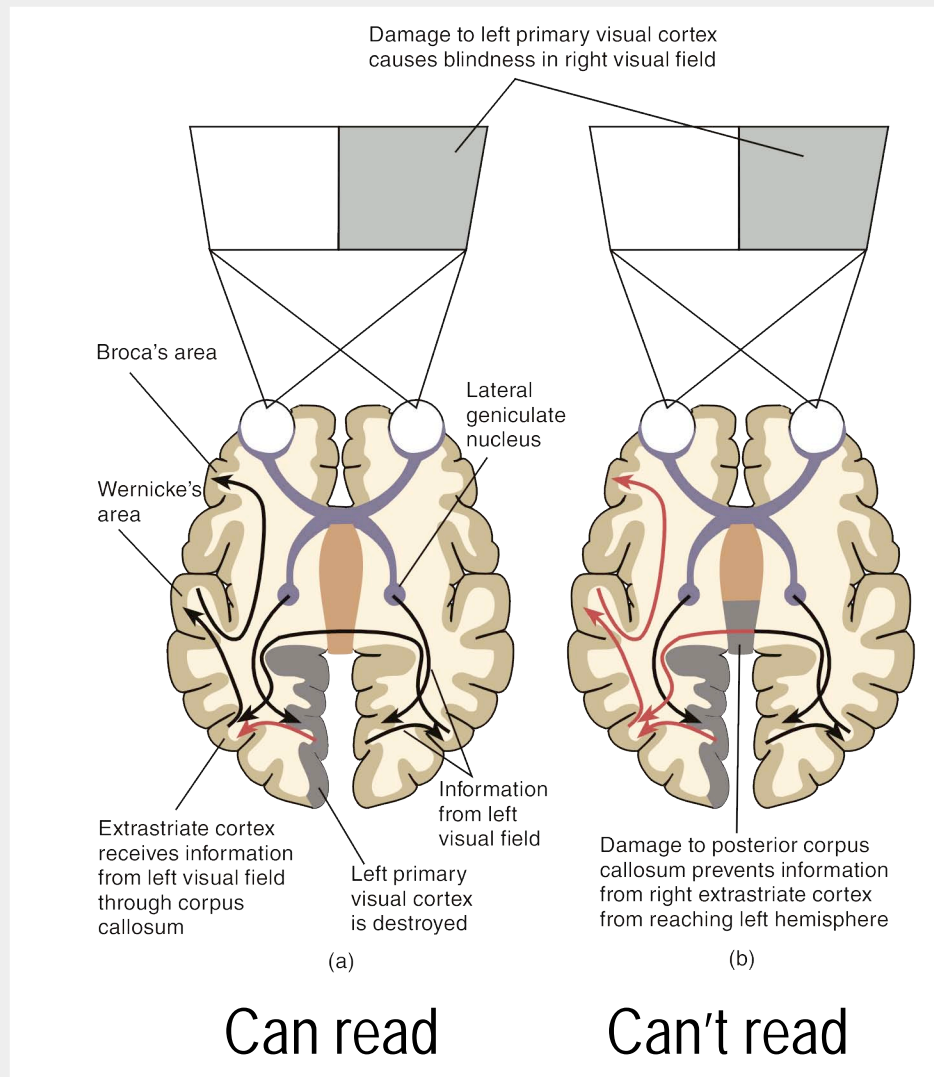
Prosody

- Prosody refers to variations in rhythm, pitch, and cadence that communicate information
 - used to distinguish questions from statements
 - prosody can communicate cues as to our emotional states
- Prosody is not disrupted in Wernicke's aphasia (speech is fluent but meaningless)
- Prosody is severely disrupted by
 - Damage to the right hemisphere (musical aspect of prosody...)
 - Damage to Broca's area

Reading Disorders

- Pure alexia refers to the inability to read (or "*alexia without agraphia*")
- Pure alexia is produced by
 - Damage to the left visual cortex and the posterior end of the corpus callosum
 - Person could write, but could not read what he wrote
- In pure alexia, word recognition carried out by right extrastriate cortex cannot reach the speech regions of the left hemisphere
- The flow of information during reading is from
 - retina --> striate cortex --> extrastriate --> CC
 - contralateral extrastriate --> Wernicke's A. --> Broca's Area

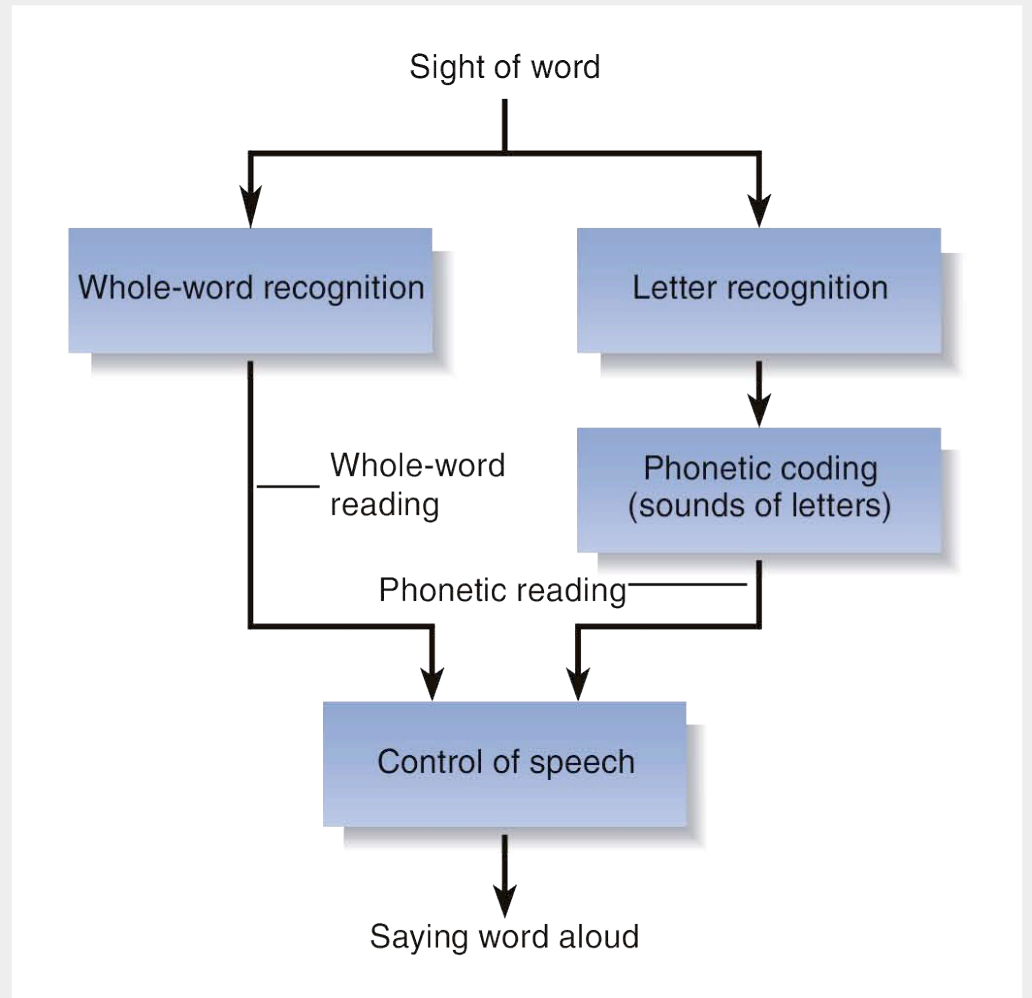
Neuroanatomy of Pure Alexia



Reading

Reading involves two processes:

- Recognition of the entire word (whole-word approach)
- Sounding out the word, letter by letter (phonetic approach)



Acquired Dyslexias

Dyslexia refers to “faulty reading”

- Acquired dyslexias are produced by brain damage in persons who were able to read
 - Surface dyslexia: deficit in whole-word reading (can sound words out)
 - Phonological dyslexia: person can read using the whole-word method, but cannot sound out words
 - Spelling dyslexia: deficit in both whole-word and phonetic reading
 - Direct dyslexia: person are able to read aloud, but do not understand what they are reading

Developmental Dyslexias

Developmental dyslexias

- Involve a reading difficulty in a person of otherwise normal intelligence
- Have a genetic component that may be related to chromosomes 6 and 15
- Have NOT been linked by imaging studies to abnormalities of specific brain regions
- May involve abnormalities of the magnocellular system within the lateral geniculate nucleus (LGN)
 - Magnocellular system provides information about movement, depth and differences in contrast
 - Dyslexia may involve a perceptual disorder in which letters appear to move, are blurry, or merge together