Language 4

Language & the Brain: Aphasia

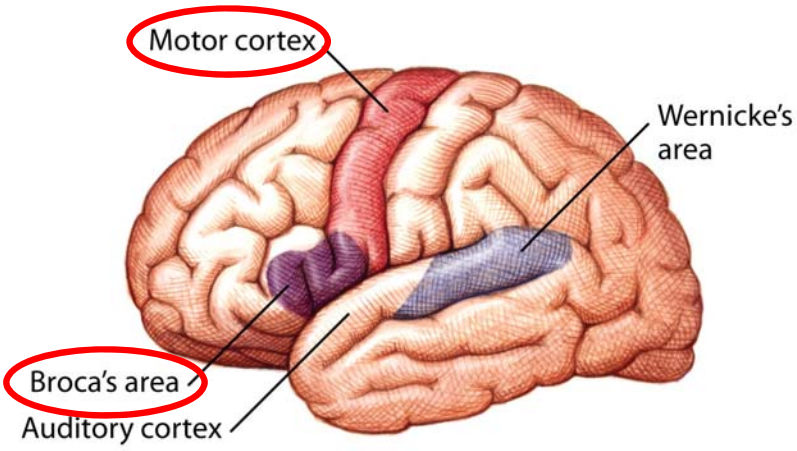
Language vs. Speech: Babbling

Language in other Animals

- *Aphasia* is an acquired condition in which there is impairment of _____ .

A. Speech production
B. Speech perception
C. Language comprehension
D. Any combination of (a) – (c)

Broca's aphasia



Damage to the Left Interior Frontal Gyrus (LIFG)

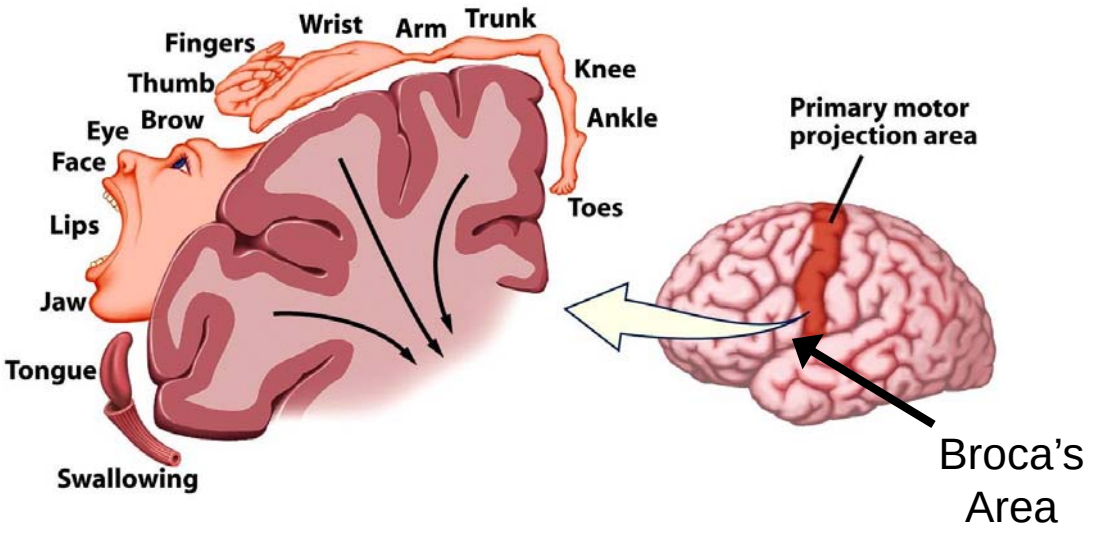
Characterized by

- Relatively good comprehension
- Slow and effortful speech
- Telegraphic speech: tendency to omit "function words" (e.g., a / of / is)

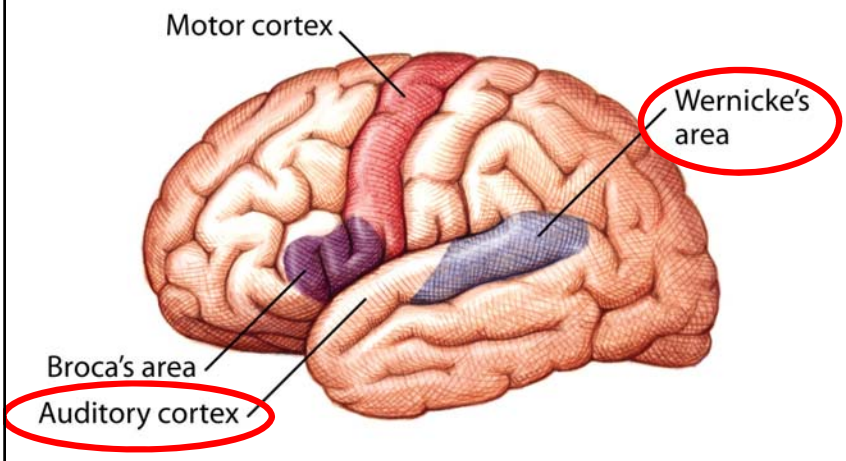
Example of a speech produced by a patient with Broca's aphasia:

http://www.youtube.com/watch?v=1aplTvEQ6ew

Localization of Function in the Motor Strip



Wernicke's aphasia



Damage to the posterior, Superior Temporal Gyrus (pSTG)

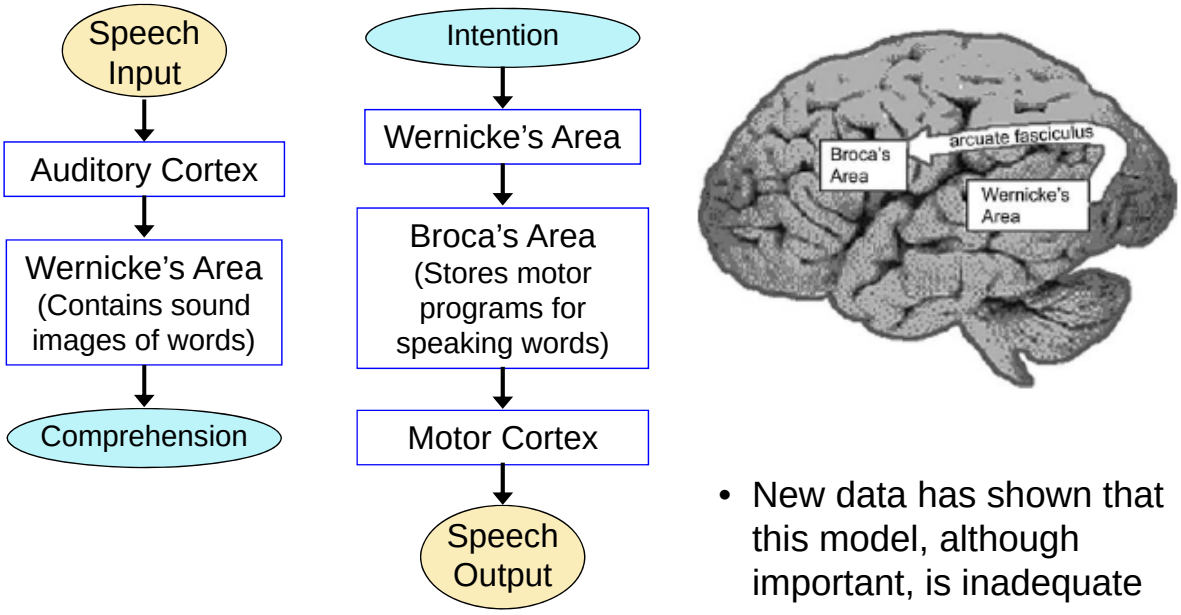
Characterized by

- Fluent but frequently meaningless speech
- Word substitution errors
- Impaired comprehension

Example of a speech produced by a patient with Wernicke's aphasia:

http://www.youtube.com/watch?v=B-LD5jzXpLE&NR=1

Wernicke-Geschwind Model

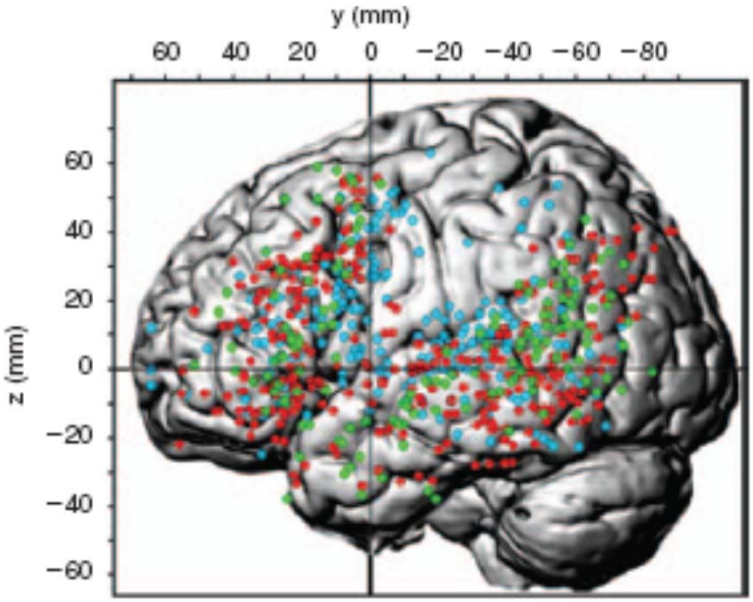


- New data has shown that this model, although important, is inadequate

Functional Localization and Lateralization of Speech

- The Wernicke-Geschwind model influenced thinking in two important ways
  - It encouraged thinking of the left hemisphere as the “language” hemisphere, with primary responsibility for both comprehension and production of language
  - It encouraged thinking of language as highly localized

Brain Imaging Results Implications for Localization



Vigneau *et al*. (2006)

- Phonology
- Semantics
- Structure

- Poor localization
  - Distributed processing networks

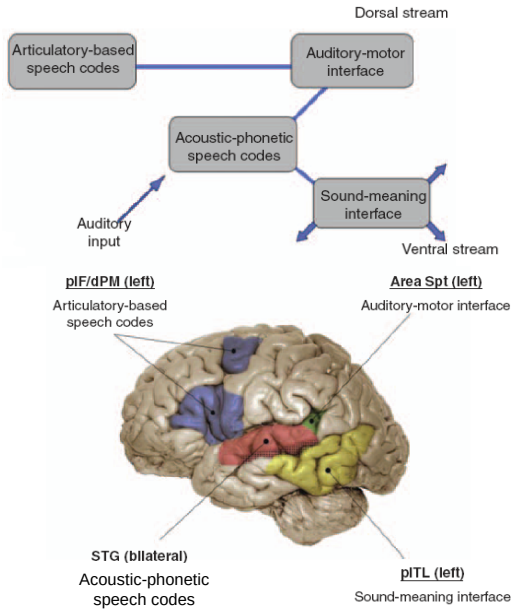
Role of the Right Hemisphere

- There is good evidence that *both* sides of the brain, not just the left, contribute to speech and language *input processing* – speech perception and comprehension.
- Language *output*, the planning and control of speech, is weighted toward the left hemisphere in more than 90 per cent of the population.
- The right hemisphere seems to be used preferentially to interpret sophisticated communications like jokes, metaphors, and irony

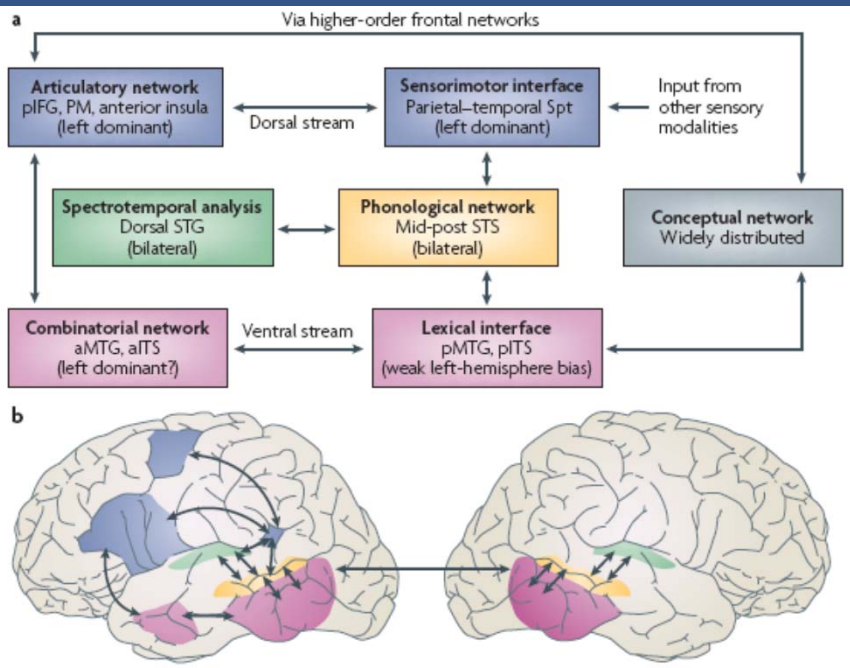
Summary: Wernicke-Geschwind model

- Historically important, suggesting that
  - Left hemisphere is the “language” hemisphere
  - Language processing is strongly localized
- Newer brain imaging data required that both of these suggestions be revised

Hickok-Poeppel (2004) Model of Auditory Language



Hickok-Poeppel – 2007 version



Summary: Progress in Science

- Scientific theories are ***never*** complete and correct.
  - Generally they are more accurate than the ones they replace.
- Wernicke and Geschwind were not wrong on the evidence
  - It remains true that damage to Broca's area will tend to impair speech output, while damage to Wernicke's area and neighboring regions tends to degrade speech and comprehension
  - As new and better data became available, this model was both incomplete and contradicted by observations
- Hickok-Poeppel is "better" because it can explain more of what has been observed
  - They have already replaced their first published original model
  - Their current model will undoubtedly be refined and superseded

- The vocal babbling of babies is most likely _____.

A. Of little or no consequence

B. A way to practice and develop their vocal apparatus

C. A reflection of their developing language ability

Babbling as Raw Form of Language

- Babbling
  - Not simply motor practice
  - “Playing with the raw form of human language”
  - Language without meaning
- If language is symbols and principles to combine them,
  - The output modality of babbling should not matter
  - Babbling should exist for sign language
- Measurement problem:
  How to distinguish babbling from other gestures
- Language does not need speech to be expressed

- Which statement best describes your opinion about the use of language by animals?

A. The potential for language is as strong in other animals as it is in humans; however, that capacity is less well developed.

B. Some animals have the mental capacity for language, but this is not develeoped because they lack bodies capable of speech.

C. Some animals are capable of producing and comprehending limited forms of language.

D. Most animals can communicate but lack the capacity for language as we understand it.

Comparing Language in Humans and other Animals

- Is there some obvious difference between the brains of humans and other animals that might help us understand language processing?
- A human adult is about 20% larger than a chimpanzee, but has a brain 4 times larger
  - Whales and elephants have brains larger than ours
- Although smaller, the brains of chimpanzees are similar in shape and structure to ours.

Comparing Language in Humans and other Animals

- Can other animals learn language?
  - Simple associations of symbols and objects/actions in the world
  - Ability to understand and produce – even creatively – simple combinations of symbols
  - Ability to understand and process abstract concepts (not necessarily a part of language)
  - Ability to understand and produce complex symbol combinations
  - Ability to infer structure

Summary: Language in Other Animals

- Animals have communication but not language in its most general sense
- No one has yet identified the differences between the brains of humans and other animals that have allowed humans uniquely to develop language
- The lack of a clear-cut structural difference supports the hypothesis that language is not a result of a few, localized brain areas specialized for language.

Looking Forward

- Wednesday: Chapter Test on Language
- For Friday
  - Gleitman: Ch. 14, pp. 545 – 562
  - Norton Reader:
    Gopnik at al., pp. 146-153
- I will go to Phoenix Grill for coffee today