

Language 4

Language & the Brain: Aphasia
Language vs. Speech: Babbling
Language in other Animals

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

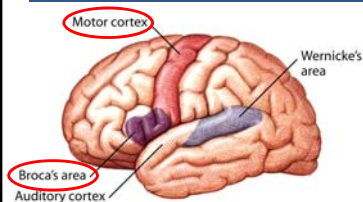
- A. Speech production
- B. Speech perception
- C. Language comprehension
- D. Any combination of (a) – (c)

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Broca's aphasia



Damage to the Left Inferior 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:

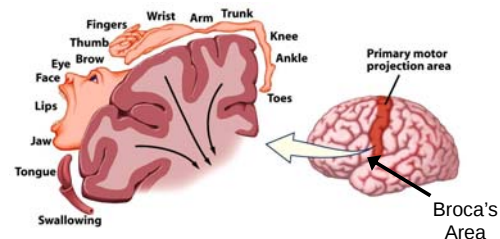
<http://www.youtube.com/watch?v=1aplTvEQ6ew>

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Localization of Function in the Motor Strip

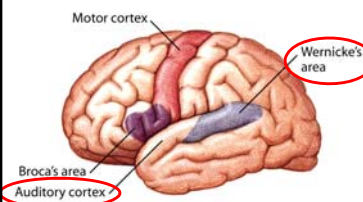


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Wernicke's aphasia



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:

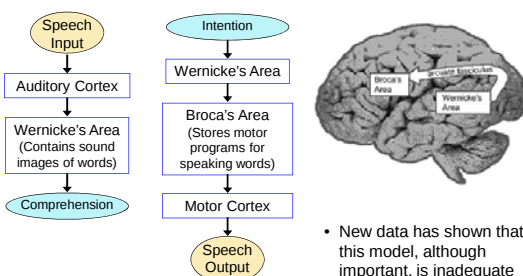
<http://www.youtube.com/watch?v=B-LD5jzXpLE&NR=1>

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Wernicke-Geschwind Model



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Functional Localization and Lateralization of Speech

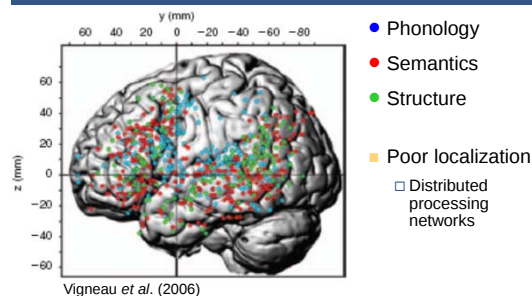
- The Wernicke-Geschwind model influenced thinking in two important ways
 - It encouraged thinking of the left hemisphere as the “language” hemisphere, with primary responsibility for both comprehension and production of language
 - It encouraged thinking of language as highly localized

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Brain Imaging Results Implications for Localization



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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

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Summary: Wernicke-Geschwind model

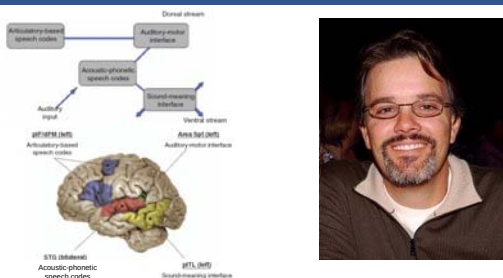
- Historically important, suggesting that
 - Left hemisphere is the “language” hemisphere
 - Language processing is strongly localized
- Newer brain imaging data required that both of these suggestions be revised

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Hickok-Poeppel (2004) Model of Auditory Language

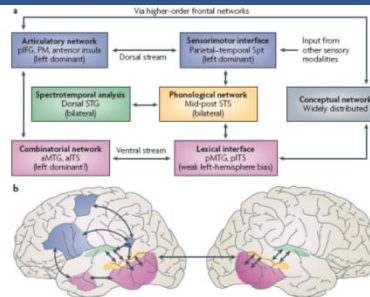


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Hickok-Poeppel – 2007 version



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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

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- 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

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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

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- 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 developed 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.

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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.

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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

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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.

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Looking Forward

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

Thinking 4

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