Language and the Brain

- All humans use language

25 year old woman
In-utero stroke in right hemisphere
Good language!

Language Processing

- Primary Auditory Cortex:
  - Tonotopic Organization
  - Heschl’s Gyrus (BA 41)
- Wernicke’s Area (BA 22)
  - Posterior aspect of superior temporal gyrus
  - Secondary auditory cortex
- Broca’s Area (BA 44/45)
  - 3rd frontal convolution of the left inferior frontal gyrus

Arcuate Fasiculus
- Connective fibers between Wernicke’s and Broca’s areas
Supramaginal Gyrus (BA 40)
- Integrates visual and spatial information from occipital and parietal lobes with auditory information
Angular Gyrus (BA 39)
- Integrates other information
  - Plays a role in reading comprehension by matching phonemes to graphemes (sounds to words)
  - Reading and writing
Wernicke-Geschwind Model

Language and Laterality

- Left hemisphere specialization
  - Major Player
    - Comprehension
    - Production
    - Meaning
  - Right hemisphere specialization
    - Emotion in language
    - Prosody
      - Aprosodia

Domains of Language

- Spontaneous Speech
- Repetition
  - Words, phrases, sentences, tongue twisters
- Speech Comprehension
  - Simple and complex commands
- Naming
  - Objects, colors, shapes, letters, numbers
- Reading
  - Read aloud, follow written instructions
- Writing
  - Copy, write to dictation, compose sentences
Language Disorders: Aphasia

- A disturbance of language usage or comprehension
- Spoken, written, or gestured
- Not due to motor dysfunction of the mouth/vocal cords (dysarthria)
- Most frequently caused by...?

Broca’s aphasia

- Expressive Aphasia, Nonfluent aphasia
- Primary deficit is in speech production
- Comprehension +/- intact
- Phonemic paraphasias
- Speech is effortful, hesitant, and dysarthric
Broca’s Aphasia

- M.E. Cinderella... poor... um... dopted her... scrubbed floor, um, tidy
- Si-sisters and mother... ball. Ball... shoe...
- Examiner. Keep going.
- M.E. Scrubbed and uh washed, sisters and mother, prince, Cinderella hooked prince. (Laughs.) Um, um, shoes, um, twelve o’clock ball, finished.
- Examiner. So what happened in the end?
- M.E. Married.
- Examiner. How does he find her?
- M.E. Um, Prince... Prince, and Cinderella meet, um... met... met...
- Examiner. What happened at the ball? They didn’t get married at the ball.
- M.E. No, um, no... I don’t know. Shoe, um... found shoe...

Distinguishing Aphasics

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Wernicke's Aphasia

- Receptive Aphasia, Fluent Aphasia
- Primary deficit in language comprehension
- Others AND self
- Speech is fluent, but not in proper grammatical form; word meaning is lost
- Incoherent
- Patients don’t realize they aren’t making sense

Well this is ..., mother is away here working her work out o'here to get her better, but when she's looking, the two boys looking in other part. One their small tile into her time here. She's working another time because she's getting, too.

Wernicke's Aphasia

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Conduction Aphasia

- Impaired Repetition
- Lots of hesitations and word-finding pauses
- May have intact reading abilities
- Damage to arcuate fasciculus; connection between Broca’s area and Wernicke’s area

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Global Aphasia

- Overall decrease in language function in multiple domains
- Most widespread deficits of all the aphasias
- Generally due to damage in multiple perisylvian regions
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## Transcortical Aphasias

- **Motor**
  - Broca-like disturbed spontaneous speech; often halting
  - Good repetition, comprehension
  - Disruption between conceptual word representations and motor speech output
  - Lesion: White matter tracts connecting Broca's area to parietal lobe

- **Sensory**
  - Wernicke-like impairments in word comprehension
  - Good repetition
  - Normal recognition of auditory words, but no activation of meaning
  - Reading and writing affected
  - Lesion: Disruption of white matter tracts between parietal and temporal lobes, or angular gyrus lesions

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Anomia
- Impaired single word production
- Mostly “everyday” nouns
- Repetition and comprehension intact
- Impaired storage or access to lexical information
- Damage to inferior parietal lobe or damage within the perisylvian region. Can also be seen in dementia.

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Additional Language Errors...
- Paraphasias-“misspoken word”
  - Phonemic- Substituting a similar *sounding* word or syllable
    - flute for fruit
    - bleaver for beaver
  - Semantic- Substituting a word with a similar *context*
    - orange for apple
    - goat for sheep
Neuropsychological Testing and Language

- Boston Diagnostic Aphasia Examination
  - 2 part test: free speech and formal testing
  - Administration time 90-120 minutes
- Boston Naming Test
  - Ability to name pictured objects
  - Administration time 10-20 minutes
- Controlled Oral Word Association
  - Test of fluency
  - 5-10 minutes
- Token Test

- Peabody Picture Vocabulary Test
  - Test of hearing vocabulary in children initially, since has been standardized with adults and clinical populations
  - Administration 10-20 minutes