Introduction to Cognitive Neuroscience
Summer 2008

Intro to Cognitive Neuroscience

Language production

But first, that paper

- Carlyon, R. (2004). How the brain separates sounds. *Trends in Cognitive*

  - *Science*, 8 (10), p 465 - 471.

Language production

Message
- Idea to be conveyed (non-linguistic)

Grammatical encoding
- Selecting words
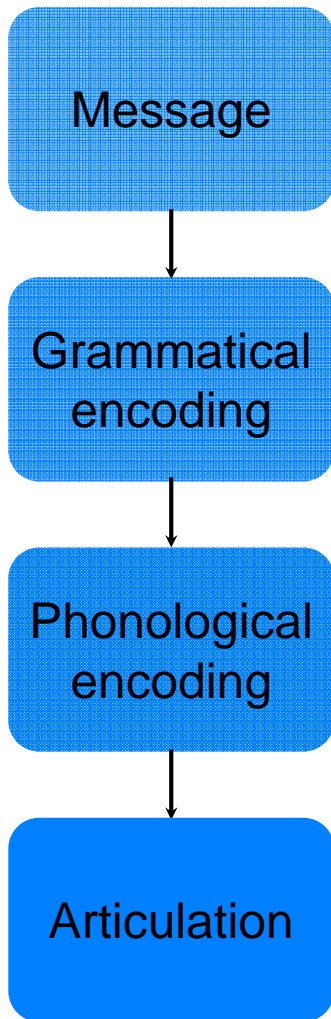- Developing sentence structure

Phonological encoding
- Phonological representation of sentence is developed.

Articulation
- Actual production of speech

Be a neuroscientist!

Message

↓

Grammatical encoding

↓

Phonological encoding

↓

Articulation

- Hypothesis: Language production involves distinct phases.

- Your mission: Design an experiment that would test this hypothesis.

    - What's the IV? The DV? How will you define these such that you can measure them?

    - What results would support your hypothesis?

Language centers

- Marsel Meslaum - language circuits in the brain.

- Rote language production uses just motor and pre-motor areas.

- Hearing words activates primary auditory cortex, then unimodal association areas.
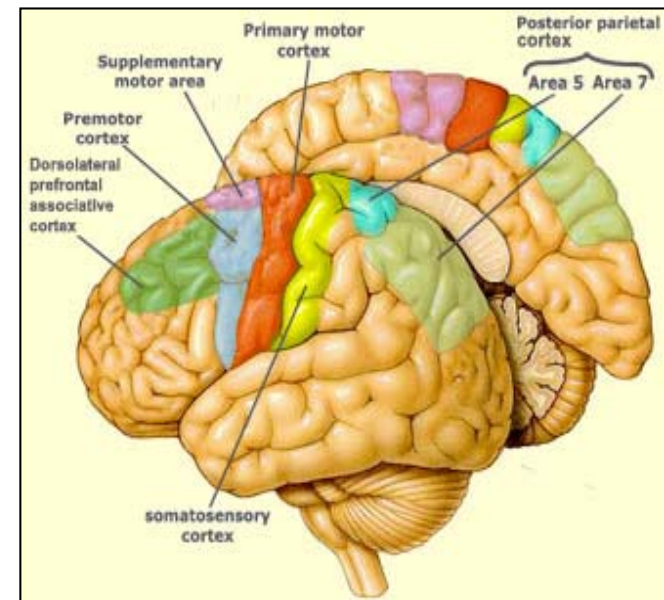
Language processing at different levels

- PET scan (subtractive) of participants doing different language tasks.

Image removed due to copyright issues. To see an image of a PET scan of participants doing different language tasks, click on the following link.

http://plato.stanford.edu/entries/innateness-language/PosnerRaichle.jpg

Errors in speech production

- Exchange errors - when two elements of a sentence are transposed.

- Word-exchange error: *I wrote a mother to my letter.*

- Sound-exchange error (aka spoonerism): *You have hissed all my mystery lectures!*

The Capitol Steps, a political humor group, has produced
segments called "Lirty Dies" that use exchange errors. Click
on the link to see examples.

http://www.capsteps.com/lirty/

Grammatical encoding

- Word selection requires relating semantic information from the message to individual words.

- Occasional errors that are a blend of two different words.

- How can you study how sentence syntax develops?

Grammatical encoding

- Language production study disguised as a memory experiment.

- Bock hypothesized that some words are quicker to choose, and a sentence structure is created that puts those words first.

- Subjects were shown pictures, instructed to say a sentence out loud about each picture.

- Accessibility of words was modified by priming.

Five-minute writing

- Write a paragraph summarizing a main idea from the reading.

Phonological encoding

- Speaker must retrieve phonological information about each word.

- Tip-of-the-tongue states occur when the connection between the semantic and phonological representation for a word is blocked.

- TOT states are more common for uncommon words.

- Severe TOT states can arise from brain injury.

Phonological and grammatical interactions

- Does information from phonological levels influence grammatical levels?

- Word exchange errors occur more often in words with similar phonemes.

Articulation

- Articulation is basically a matter of very fine motor control.

- A disproportionately large amount of motor cortex is devoted to the lips, jaw, and tongue.

Image courtesy of Bruno Dubuc, The Brain From Top to Bottom

Image removed due to copyright issues.

To see a detailed diagram of the Motor Cortex click on the following link.

http://pine.psych.cornell.edu/educational/brain_areas/motorcortex.gif
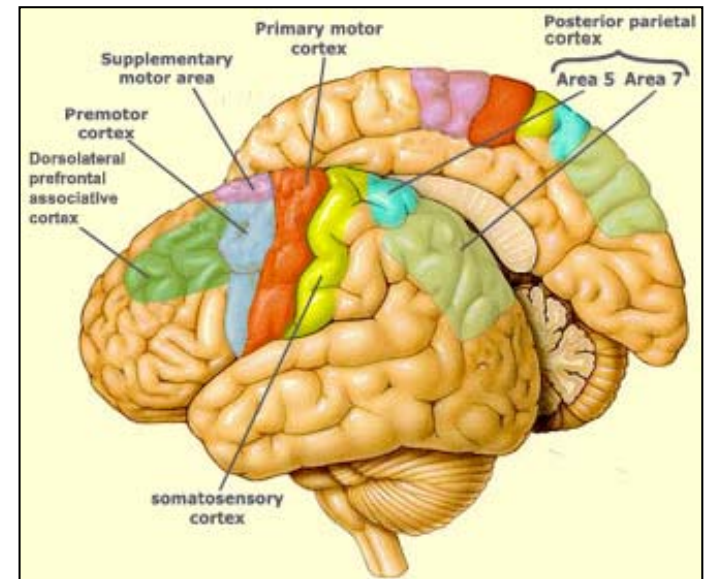
Articulation

- Primary motor cortex (M1) controls fine motor abilities.

- Premotor area sets up sequences of actions, especially in response to perceptual information.

- Supplementary motor area is involved in action plans.

Writing

- Written language tends to vary from spoken language.

    - Often produced in isolation.

    - More complex syntax.

    - Opportunities for revision after production.

Speaking of writing...

- Essay question for this week is <u>changed</u> from that on the syllabus.

    - Explain how context is involved in at least two aspects of language processing. You could consider speech perception, ambiguous words and sentences, discourse-level organization, evidence from speech errors, or other aspects of language.