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.

Image courtesy of Bruno Dubuc, The Brain From Top to Bottom
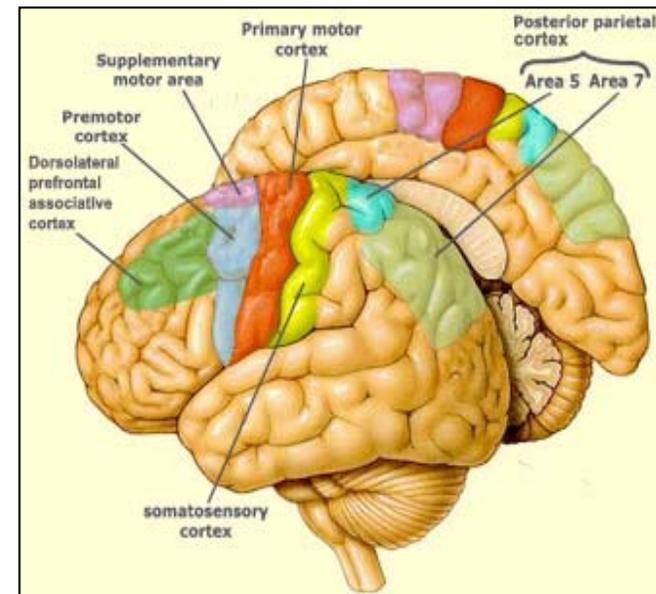
Language processing at different levels

- 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
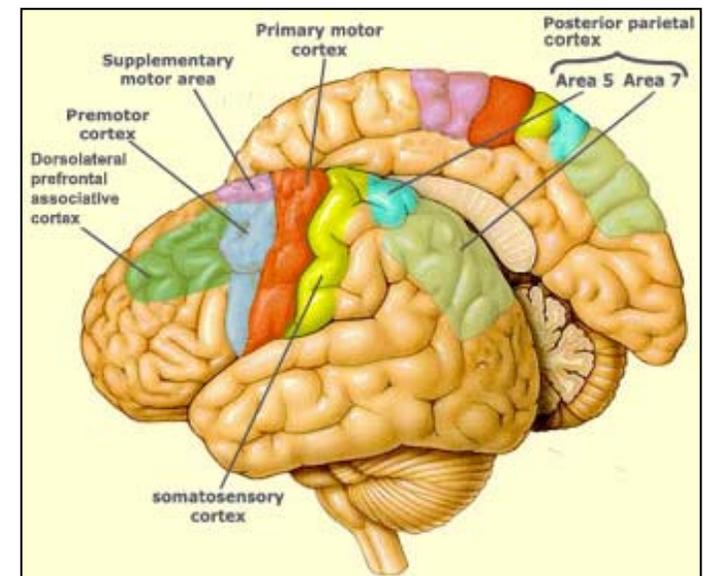
Articulation

- 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.

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