Roadmap

- Features of language
- Chomsky vs. Skinner revisited
- Language and cognition
- Study of language
- Cognitive approaches to the study of language
- Speech perception
- Word recognition
Learning objectives of the day

• What are the major differences between human language and animal communication?
• How does Chomsky’s and Skinner’s view on language differ?
• What are the subfields of linguistics? Can you describe what those fields are about?
• What kind of cues do we use in speech perception and word recognition?
• What are the cognitive processes involved in understanding speech in noisy environment or degraded context?
• How do prototype and exemplars account for speech perception?
A semantic network of language in BCS111

Language

- Sentences
- Words
- Morpheme
- Phoneme
- alphabet

A tool for communication
Another famous ape: Kanzi

- Use of lexigrams
- Learned it by observation
Key features differentiating human language from animal communication?

- Arbitrariness
- Productivity
- Displacement
- Duality of patterning
- Reflexiveness
- Cultural transmission
Animal communication: Clever Hans effect
Views on language
Chomsky vs. Skinner
Views on language
Chomsky vs. Skinner

- Generative grammar
- Formal syntax and phonology
- Reinforcement and conditioning
- Stimulus-response
- Behavioral studies of verbal behavior
Generative grammar: what’s being generated?

• Sentences
  S → NP VP
  S → NP VP PP

• Sound changes
  the /p/ in ‘sport’ vs. ‘port’
The role of language in cognition

• Verbal behavior
• Labels of objects
• Declarative memory
• Working memory – phonological loop
• Socialization
• Norm of human intelligence
...etc.
Intelligence without language?

2. This sequence of four words, "triangle, glove, clock, bicycle," corresponds to this sequence of numbers "3, 5, 12, 2."
   - True
   - False

3. 27 minutes before 7 o'clock is 33 minutes past 5 o'clock.
   - True
   - False

4. The word "because" can be spelled by using the first letters of the words in the following sentence: Big Elephants Can Always Understand Small Elephants.
   - True
   - False

5. If written backwards, the number, "one thousand, one hundred twenty-five," would be written "five thousand, two hundred eleven."
   - True
   - False
Study of Language

- Syntax
- Semantics
- Phonology
- Phonetics
- Morphology
- Pragmatics
Phonology vs. Phonetics

• Phonology
  ➢ Language-specific
  /str/: possible in English but not in Japanese

• Phonetics
  ➢ Acoustics and articulation of sounds
Interdisciplinary study of language

- Psycholinguistics
- Neurolinguistics
- Computational linguistics
- Cognitive linguistics
- Philosophy of language
- Sociolinguistics
- Anthropological linguistics
- Historical linguistics
Cognitive approaches to the study of language

- Language development
- Language and thought
- Language and reasoning
## Language and thought

### Examples of stimuli and responses, showing the effect of verbal labels

<table>
<thead>
<tr>
<th>Curtains in a window</th>
<th>Diamond in a rectangle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottle</td>
<td>Stirrup</td>
</tr>
<tr>
<td>Eyeglass</td>
<td>Dumb-bell</td>
</tr>
<tr>
<td>Kidney bean</td>
<td>Canoe</td>
</tr>
<tr>
<td>Crescent moon</td>
<td>Letter “C”</td>
</tr>
<tr>
<td>Two</td>
<td>Eight</td>
</tr>
<tr>
<td>Ship’s wheel</td>
<td>Sun</td>
</tr>
<tr>
<td>Hour glass</td>
<td>Table</td>
</tr>
<tr>
<td>Beehive</td>
<td>Hat</td>
</tr>
<tr>
<td>Pine tree</td>
<td>Trowel</td>
</tr>
<tr>
<td>Gun</td>
<td>Broom</td>
</tr>
<tr>
<td>Seven</td>
<td>Four</td>
</tr>
</tbody>
</table>
Cognitive approaches to the study of language

• Perception
• Attention
• Working memory
• Long-term memory
• Concepts
  ➢ Connectionist models
    o Semantic network
  ➢ Boxes-and-arrows models
Homework 3
Cognitive approaches to the study of language

• Speech perception and spoken word recognition
  ➢ Understanding conversations in noisy environment
  ➢ Understanding conversations through telephone
  ➢ The role of attention and memory?
Acoustic cues we use in speech perception

• Duration of a sound
• Spectral properties: pitch, resonant frequencies (formants), amplitude, etc.
• Formant transitions from one sound to another
Speech perception and spoken word recognition

- Perception in degraded context

- Restore the missing phoneme
Evidence of sound transitions as a perceptual cue

• Silent center syllables (Strange et al. 1983)
  ➢ Syllable nucleus replaced by silence
  ➢ Temporal (duration) and formant transitions preserved
  ➢ 95% accurate in identifying the vowels
Perception in degraded context

• Restore the missing phoneme
  ➔ High task demand
  ➔ Increased arousal level
  ➔ Attention to acoustic details
  ➔ Matching stored memory traces
  ➔ Top-down process helps
Cognitive approaches to the study of language

• Speech perception and spoken word recognition
Cognitive approaches to the study of language

- Speech perception and spoken word recognition
  - Categorical perception (HW1)
  - Durational continuum from “pitch” to “peach”

Yellow line: “pitch” responses; Green line: “peach” responses
Cognitive approaches to the study of language

• Categorization of speech sounds

➢ What’s your prototype of /p/ in “peach”

➢ How many /p/s have you heard in your life?
Prototype and exemplars

/p/


Sam’s [p]  Mary’s [p]  Amy’s [p]
Prototype vs. exemplars

• When do we mostly use prototype in speech perception?

• When do we mostly use exemplars in speech perception?
Cognitive approaches to the study of language

• Visual word recognition

➢ Top-down process
Cognitive processes involved in the processing of imagery and words

Mountain
HAPPY HALLOWEEN