Language Part II

Language development

I'd like my first word to be memorable and profound, but I know I'll wake up from a nap one day and blurt out "Mama" like everyone else.
Overview

- Language acquisition
  - Phonological development
  - Semantic Development

- Nature/Nurture debate
12 weeks  cooing, smiles when talked to
16 weeks  turns head in response to human voice
20 weeks  makes vowels and consonant sounds
6 months  babbling (all sounds)
8 months  repeat certain syllables (ma-ma)
12 months  understands and says some words
18 months  can produce up to 50 words
24 months  more than 50 words, two-word phrases
30 months  about 100 words, phrases of 3-5 words
36 months  vocabulary of about 1,000 words
48 months  most basic aspects of language are well established
Sensitivity to English phonetic contrasts as function of age: Evidence for a critical period

Figure 1  Effects of age on discrimination of the American English /ra-la/ phonetic contrast by American and Japanese infants at 6–8 and 10–12 months of age. Mean percent correct scores are shown with standard errors indicated.
Video (~5 min): critical period for learning phonemes
(talk by Patricia Kuhl)

Importance of Social Interaction in Language Acquisition

Fig. 2. (A) Experiment 1. Effects of live foreign-language intervention in infancy. Mandarin Chinese speech discrimination tests conducted on infants after exposure to Mandarin Chinese (red stripes) or American English (blue stripes) show significant learning for the Mandarin-exposed infants when compared with the English controls. (B) Experiment 2. Mandarin Chinese foreign-language exposure in the absence of a live person (AV or A) shows no learning. (C) Results of the same Mandarin speech discrimination tests on monolingual Mandarin-learning (red) and English-learning (blue) infants.

Kuhl, Tsao, & Liu (2003)
Finding the Words

• There are no pauses in speech signal to mark boundaries between words. How can children learn to segment a continuous stream of sounds?

• One proposal: children learn from the statistical information in speech stream (e.g. co-occurrence frequencies of syllables)
• Continuations *within* words are systematic
• Continuations *between* words are arbitrary
Evidence for statistical learning: Saffran, Aslin, and Newport (1996)

Training:

pabikugolatupabikudaropi

... 

Testing:

word part-word

pabiku kudaro
The Vocabulary Burst

• Rapid increase in the rate of word learning in very early childhood.

  – 10,000 words by 1\textsuperscript{st} grade
    • 5.5 per day from 1.5 to 6 yrs
  – 40,000 words by 5\textsuperscript{th} grade
    • 20.5 per day from 1\textsuperscript{st} to 5\textsuperscript{th} grade

• Learning challenge: how does a child even know what words refer to?
Quine (1960): problem of referential indeterminacy

Gavagai means: __________________________
Word-learning Constraints

• To limit the possible interpretations, children use a set of social cues and word-learning constraints which limit the kind of hypotheses that the child entertains

• Allows for rapid word learning based on only few examples

• Examples of word-learning constraints:
  – whole object constraint
  – mutual exclusivity
  – taxonomic constraint
The Lorax, Dr. Seuss

Whole object constraint

What does *thneed* mean?

- piece of clothing
- pink
- fuzzy
- sleeve
- hem
- fabric
Mutual Exclusivity

• Mutual exclusivity: an entity cannot have more than one name (Carey, 1978)

• “Look at the Dax”
ADULT: I am going to show you a dax. See this?

ADULT: Can you find another dax?
Learning words in context -- Deb Roy’s research

• Installed video camera’s throughout his own house to record all interactions with his son
• Tracked the progression of learning – e.g. all instances and contexts where his son said “Water”

http://www.media.mit.edu/cogmac/projects/hsp.html
Video: learning words in context – Deb Roy (~3 min)

Segment taken from: http://www.ted.com/talks/deb_roy_the_birth_of_a_word.html
http://www.media.mit.edu/cogmac/projects/hsp.html
NATURE / NURTURE
Nature v. nurture debate

• How much of language development is due to experience and learning from our environment (nurture) vs. our genetic makeup (nature)?

• Easy question: is the language we learn due more to nature or nurture?
  A. Nature
  B. Nurture

• Difficult question: is our actual ability to learn language due more to nature or nurture?
  A. Nature
  B. Nurture
Nurture

- Behaviorists (e.g. Skinner) suggested that language might be acquired by simple learning mechanisms
  - Learning by imitation (e.g. parents)
  - Learning by association
  - Learning by conditioning
  - [modern perspective: Statistical learning]
However there are limits on reinforcements: parents rarely provide negative feedback on grammar

- Example:
  
  Child: “Barney be going soon?”

  Mom: “That’s right. Good job. Barney will be over in a little while. Then we need to go to the store.”

- Parents may even reinforce incorrect grammar (if idea is true)
Correcting children's grammar doesn't help much

Child: My teacher holded the baby rabbits and we patted them.

Mother: Did you say, your teacher **held** the baby rabbits?
Child: Yes.

Mother: What did you say she did?
Child: She holded the baby rabbits and we patted them.

Mother: Did you say she **held** them tightly?
Child: No, she holded them loosely.

(Bellugi, 1971)
Objections to Behaviorist account

Some findings that Behaviorism cannot easily explain:
1) Novel words and utterances
2) Sensitive periods for language development
3) Creation of new languages: Creolization
4) Inability of other species to create complex linguistic utterances even when exposed to language (next lecture)

→ these findings are used to support nativism
Novel Utterances

• Children can utter **new words and sentences** for which they have never been reinforced
  – E.g. incorrect past tense “holded” vs. “held”

• Despite children’s linguistic environment being fragmented, reinforcement being inconsistent, and children receiving little feedback, tremendous consistency in the way children learn grammar
Sensitive Periods: evidence from isolated children

• Normal language development may take place as long as language learning begins during a sensitive period. The sensitive period may end at the age of puberty.

<table>
<thead>
<tr>
<th>Genie: found age 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Confined by controlling father</td>
</tr>
<tr>
<td>• Chained to crib, physically punished if made sound</td>
</tr>
<tr>
<td>• Mute, no language comprehension</td>
</tr>
<tr>
<td>• 2 years after rescued, could utter strings of phrases but little understanding of structural rules (e.g., question words absent)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Isabelle: found age 6 1/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lived with deaf-mute incarcerated mother in dark room separated from rest of the family</td>
</tr>
<tr>
<td>• No exposure to language</td>
</tr>
<tr>
<td>• Made unintelligible sounds</td>
</tr>
<tr>
<td>• Within 2 years of rescue, could produce and comprehend fairly complex sentences, and spoke following standard grammar rules</td>
</tr>
<tr>
<td>• Eventually acquired full adult-like speech in complexity</td>
</tr>
</tbody>
</table>
Sensitive periods
evidence from second language acquisition

![Graph showing the mean number correct for English grammaticality judgments by Chinese and Korean individuals who came to the US at different ages. The graph shows a decrease in the mean number correct as age of arrival increases from Native to 17-39 years.](image)
From Pidgin to Creole languages

• Other evidence for nativism comes from the creation of new languages

• Creole language: based on two or more other languages but serves as native language for its speaker
From Pidgin to Creole languages

- On plantations, native speakers of numerous unintelligible languages thrown together, had to communicate

- Adults developed simplified speech ("pidgin") that contained few if any grammar rules
  - Contact language, only spoken face-to-face
  - Barely sufficient to allow communication among adults
From Pidgin to Creole languages

- Children of pidgin-speaking parents do not continue to speak pidgin.

- Children *created grammatical structure* and complexity ("creole")

- Same syntactic complexity as found in other languages

- This change from pidgin to creole is called **creolization**
Nativist argument

• The fact that, over time, children imposed grammatical structure suggests that they had an innate bias to do so.

• Because it emerged from adults speaking pidgin, it is argued that it could not be learned.
Chomsky’s nativist view

• Human language learning appears to be innate in a way that violates behaviorist expectations. We seem to be born with an innate capacity to acquire language (Nativism).

• Chomsky proposed that humans are equipped with a language acquisition device (LAD). The LAD is a language processor which contains a universal grammar, common to all languages.
Synthesis: Nature AND Nurture

- Experiments on statistical learning suggest that many low-level aspects (e.g., phonemes, word units) of language can be learned.

- More complex aspects of language (e.g. syntax) suggest presence of innate biases

- Both nature and nurture play valuable roles in language learning. For proper language development you need a human brain and a human environment.