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.
What makes language learning challenging:

- The child has to distinguish which sounds are speech
- Segment speech into words
- Figure out the meanings of words: semantics
- Figure out the rules governing word order: syntax
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)

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)
Statistical Learning

- 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: ____________________

(Quine: Word and Object, 1960)
Word-learning Constraints

- To limit the possible interpretations, children use a set of **word-learning constraints and social cues** 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
What does *thneed* mean?

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

The Lorax, Dr. Seuss
Mutual Exclusivity

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

- “Look at the Dax”
Taxonomic Constraint: words refer to categories of similar objects

ADULT: I am going to show you a dax. See this?

ADULT: Can you find another dax?
Importance of Social Cues

(A) If the parent is looking at the toy when saying a new name, the child will assign the name “dax” to the toy.

(B) If the parent is looking at something else when saying a new name, the child will not assign the name “dax” to the toy.
Nature vs. Nurture debates for Language Learning

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

• Theoretical approaches:
  – Behaviorist explanations
  – Nativist explanations
  – Interactionist explanations
Behaviorist Explanations

- Behaviorists (e.g. Skinner) suggested that we learn to talk in the same way we learn any other skill: through reinforcement, shaping, extinction, and the other basic principles of operant conditioning.
Nativist Explanations

• Chomsky argued that language (especially syntax) is too complex for children to pick up from environmental input alone

• An infinite number of different grammars could be inferred from the utterances a child hears unless the child was designed to look only for the kinds of grammars found in human languages
Chomsky’s nativist view

- Language development is best explained as an innate, biological capacity.

- 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.
Problems with behaviorist explanations

• Parents rarely correct or 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)
Overregularization errors

• Examples
  – Saying “holded” instead of “held”
  – saying “falled” instead of “fell”
  – saying “sheeps” instead of “sheep”

• This is evidence that children don’t learn language by imitation or memorization: They learn rules.
Arguments to support nativist explanation

1) Sensitive periods for language development

2) Creation of new languages: Creolization

3) Inability of (most) other species to create complex linguistic utterances even when exposed to language (see book)
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.

Genie: found age 13
• Confined by controlling father
• Chained to crib, physically punished if made sound
• Mute, no language comprehension
• 2 years after rescued, could utter strings of phrases but little understanding of structural rules (e.g., question words absent)

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

English Grammaticality judgments by Chinese and Korean individuals who came to the US at different ages
Summary of Sensitive Period

• Case studies from isolated children suggest:
  – Early exposure to language (e.g., Isabelle at 6) results in catch-up of language skills relative to age-equivalent peers
  – Exposure after puberty (e.g., Genie) does not
  – Drawing conclusions from case studies is problematic (e.g., small N; unknown prior deficiencies)

• Research on second language use, and acquisition of sign language, tells a similar story

• Language learning is practically *effortless* before puberty, extremely effortful after
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

For an example of creolization: https://www.youtube.com/watch?v=_VFXoqfoi6I
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.
Theoretical Approach 3: Interactionist Explanations

• Language learning can only be explained as a combination of the innate biological capacity for language with environmental experiences

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

• Social experiences contribute to language development

• More complex aspects of language (e.g. syntax) suggest presence of innate biases
New data driven approaches to understand language learning: Deb Roy’s research

- Installed video camera’s throughout his own house to record all interactions with his son
Deb Roy’s research

- Tracked the progression of learning – the word “water”

- Data driven approach allows better characterization of learning environment and history
  - all physical and social contexts where his son said “Water”