Prelinguistic development

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Developmental stages

When does L1 acquisition begin?

- 1;0       preverbal stage
- 1;0-1;6   one-word stage
- 1;7-2;0   two-word stage
- 2;0-3;0   Multi-word stage
Early speech recognition

Two months-old infants:

- recognize their mothers’ voice
- are able to differentiate speech sounds from noises
- are able to distinguish different types of languages
Early speech recognition

Two months-old infants are able to distinguish French from Russian, but fail to differentiate French from Spanish.

- Stressed-timed languages
- Syllable-timed languages
- Mora-timed languages

High-amplitude sucking procedure
Perception of speech sounds

Up to the age of 0;7 infants are able to recognize many allophonic distinctions that adult speakers may not be able to hear.

[Werker and Tees 1984]
Perception of speech sounds

\[
\begin{align*}
[t^h\text{ct}] & \quad \text{top} \quad \text{aspirated} \\
[\text{stop}] & \quad \text{stop} \quad \text{plain}
\end{align*}
\]

\[
/p\ t\ k/ \quad \rightarrow \quad [p^h\ t^h\ k^h]/\#_,\ V'
\]

[p\ t\ k] elsewhere
Perception of speech sounds

Once infants have tuned into the phonological system of their mother language, they lose the ability to discriminate speech sounds they were able to discriminate previously.

[Werker and Tees 1984]
Perception of speech sounds

[t]
Perception of speech sounds

phoneme /t/
Perception of speech sounds
Perception of speech sounds

phoneme /d/

phoneme /t/

attractor
Perception of speech sounds

phoneme /d/

phoneme /t/

attractor
Perception of speech sounds

attractor

phoneme /d/

phoneme /t/

attractor
Perception of speech sounds

“The neural resources are used for the native language at the expense of the non-native language.”

[Saxton 2010: 117]
Segmentation of the speech stream

[demse .. tyfesalesp ... esbedlaesdnd ... sj ... deneb]
Segmentation of the speech stream

- Phonological cues
- Distributional cues
Phonological cues

The discovery of spoken language

Peter Jusczyk
Intonation and pauses

Yesterday … after we had lunch … with Sally … we went to the movies.

Perceptual cues of intonation:

• Amplitude
• Duration
• Pitch

Pitch provides the strongest cue.
Pauses and intonation are important to identify utterance boundaries, but how do children identify word boundaries?
ADULT: What’s that?
CHILD: That’s a ‘raffe’.
ADULT: What’s that?
CHILD: That’s a ‘nana’.
Stress

Typical placement of English word stress:

'apple
'happy
'unhappy
'newspaper
Stress

Mother: Behave!
Child: I’m heyv.
Phonotactic constraints

English syllable structure
  CCCV
  VCCC

Phoneme sequences: [g] [d]

  ... bigdog ...  = big / dog
Allophonic variation

/\t/ \to \quad [t^h] \quad \text{top}
    \to \quad [t] \quad \text{stop}

/\l/ \to \quad [l] \quad \text{light}
    \to \quad [\l] \quad \text{call}
Allophonic variation

gadfy... sat\textsuperscript{h}as ... teys ... o\textsuperscript{1}art ... tenitre

word boundaries
Distributional cues

Nonce words:  
tupiro  
golabu  
bidaku  
padoti

Subjects: 8 months-old infants

Saffran et al. 1996
Distributional cues

tupiro – bidaku – padoti – bidaku – golabu …

Saffran et al. 1996
Distributional cues

Condition 1: tupiro-bidaku-…
Condition 2: da-pi-ku-ro-tu-…

Saffran et al. 1996
Head-turn procedure

light + auditory stimulus

green light
Distributional cues

Saffran et al. 1996
Distributional cues


100% 25%

transitional probabilities

Saffran et al. 1996
Distributional cues

Condition 1: 100-100-25-100-100-25 ...

Condition 2: 8.3-8.3-8.3-8.3-8.3 ...

Saffran et al. 1996
How do children acquire their native language? My research focuses on the kinds of learning abilities required to master the complexities of language. Three broad issues characterize my work. One line of research asks what kinds of learning emerge in infancy. A second line of research probes the biases that shape human learning abilities, and the relationship between these biases and the structure of human languages. A third issue concerns the extent to which the learning abilities underlying this process are specifically tailored for language acquisition. Related research concerns infant music perception, and the relationship between music and language learning.
Function words

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Early speech production

Infant vocal tract
Early speech production

Primate vocal tract

Human vocal tract
Early speech production

> 0;2       reflexive vocalization
0;2 – 0;6   vocal play
0;6 – 0;10  babbling
  (i) dadadada [reduplicated babbling]
  (ii) dabagidi [varigated babbling]
0;10 >     jargon (conversational babbling)
### Canonical word forms

<table>
<thead>
<tr>
<th>音节形式</th>
<th>中文含义</th>
<th>音节符号</th>
</tr>
</thead>
<tbody>
<tr>
<td>[mə̞̊jo̞̊s] or [mə̞̊jå̞n]</td>
<td>怪物</td>
<td>[CVjCV]</td>
</tr>
<tr>
<td>[tə̞̊jə̞̊k] or [tə̞̊jå̞ŋ]</td>
<td>老虎</td>
<td></td>
</tr>
<tr>
<td>[nə̞̊nå̞]</td>
<td>坦迪</td>
<td>[nVnV]</td>
</tr>
<tr>
<td>[nə̞̊nə̞̊]</td>
<td>窗户</td>
<td></td>
</tr>
<tr>
<td>[nə̞̊nə̞̊] or [nə̞̊nə̞̊]</td>
<td>手指</td>
<td></td>
</tr>
<tr>
<td>[nə̞̊nå̞]</td>
<td>另一个</td>
<td></td>
</tr>
</tbody>
</table>
## Canonical word forms

<table>
<thead>
<tr>
<th>[ɪʃ]</th>
<th>fish</th>
<th>[(C)VS]</th>
</tr>
</thead>
<tbody>
<tr>
<td>[dɪʃ]</td>
<td>dish</td>
<td></td>
</tr>
<tr>
<td>[vɛst]</td>
<td>vest</td>
<td></td>
</tr>
<tr>
<td>[bɹʃ]</td>
<td>brush</td>
<td></td>
</tr>
<tr>
<td>[fɜtʃ]</td>
<td>fetch</td>
<td></td>
</tr>
</tbody>
</table>
Phonetic assimilation

- Context-free strategies
- Context-bound strategies
Phonetic assimilation

<table>
<thead>
<tr>
<th>[dæs]</th>
<th>glass</th>
<th>Reduction of consonant cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>[bɛd]</td>
<td>bread</td>
<td></td>
</tr>
<tr>
<td>[sek]</td>
<td>snake</td>
<td></td>
</tr>
<tr>
<td>[hæn]</td>
<td>hand</td>
<td></td>
</tr>
<tr>
<td>[da]</td>
<td>star</td>
<td></td>
</tr>
</tbody>
</table>
Phonetic assimilation

Word-initial fricatives are replaced by stops

[bæn]  van
[dæt]  that
[ner]  there
[dæk]  Jack
[dæb]  jam
[dɛk]  check
Phonetic assimilation

Voicing of word-initial stops

[bɔt]   pot
[do]    toe
[dɪ]    kiss
# Phonetic assimilation

<table>
<thead>
<tr>
<th>Sound</th>
<th>Word</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>[dat]</td>
<td>duck</td>
<td>Fronting of consonants</td>
</tr>
<tr>
<td>[det]</td>
<td>gate</td>
<td></td>
</tr>
<tr>
<td>[zus]</td>
<td>shoes</td>
<td></td>
</tr>
<tr>
<td>[mæts]</td>
<td>match</td>
<td></td>
</tr>
<tr>
<td>[tæbədz]</td>
<td>cabbage</td>
<td></td>
</tr>
</tbody>
</table>
**Phonetic assimilation**

<table>
<thead>
<tr>
<th>[napeut]</th>
<th>knob</th>
<th>Devoicing of final obstruents</th>
</tr>
</thead>
<tbody>
<tr>
<td>[bæt]</td>
<td>bad</td>
<td></td>
</tr>
<tr>
<td>[dɔt]</td>
<td>dog</td>
<td></td>
</tr>
<tr>
<td>[duf]</td>
<td>stove</td>
<td></td>
</tr>
</tbody>
</table>
Phonetic assimilation

Harmonization of initial consonants (if the word ends in a velar consonant)

| [bʌt] | but            | \([gʌg]\) big            |
| [gʌk] | book           | \([gɪg]\) pig            |
| [gɔg] | dog            | \([dɔt]\) dot            |
| [gʌk] | duck           | \([gɪk]\) stick         |