When ears collide: Mismatch and phonological development

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What happens in phonological acquisition?

- **Higher-level phonological knowledge**
  - onset: \( [t] \)
  - stressed: \( [i], [u] \)
  - trochee: back\( [k] \)

- **Language-specific phonetic detail**
  - \( [t] \) onset
  - stressed \( [i] \)
  - back \( [k] \) onset
  - stressed \( [u] \)

- **Socio-indexical knowledge**
  - Buffalo
  - gay
  - male
  - child
  - NYC
  - female
  - people

- **Words**
  - \{key\}
  - \{tuna\}
  - \{cougar\}

- **Voices**
  - man's \{key\}
  - man's \{tuna\}
  - man's \{cougar\}
  - girls' \{cougar\}

- **People**
  - Ben
  - Marie
  - Aunt Jan
What happens in phonological acquisition?

• Children need to figure out how to come up with discrete categories from the continuous signal that they hear.
• We assume that there is a match between the child listener and the adult speaker.
• But what if there isn’t?
Mismatch in phonological acquisition

• **Study 1**: Child and adult have different hearing systems
  • Child: electronic hearing (cochlear implant)
  • (Almost) everyone else: acoustic hearing

• **Study 2**: Child and adult (teacher) speak different dialects.
  • Impact on literacy
Study 1: Cochlear Implants

- Recommended for individuals with severe-to-profound hearing impairment.
- Replaces acoustic hearing with an electrical signal.
- Pros: Children who are prelingually deaf do much better with a cochlear implant than with hearing aids.
- Cons: Signal is severely degraded, especially for spectral information.

A soft breeze came across from the sea.
Study 1: Electronic vs. Acoustic Hearing

- **Purpose**: To compare acquisition of an early-acquired contrast (/t/ vs /k/) in children with cochlear implants and their age peers with normal hearing.
  - Accuracy
  - Error patterns
- /t/ vs /k/ in normal-hearing English-speaking children
  - /t/ produced correctly by about age 3.
  - /k/ produced correctly by about 3;6.
  - [t] for /k/ substitutions are common.
- Place of articulation is a spectral contrast.
  - Difficult for children with cochlear implants.

Prompt = cup
Study 1: Electronic vs. Acoustic Hearing

- 20 children with cochlear implants (CI)
  - 8 females, 12 males
- 20 children with normal hearing (NH)
- Matched for age, sex, and maternal education

<table>
<thead>
<tr>
<th>Group</th>
<th>Age in months mean (SD) n = 32</th>
<th>Maternal Education n = 20</th>
<th>Vocabulary (EVT-2) mean (SD) Standard: 100 (15) n = 32</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI</td>
<td>51 (10) Range = 31-69</td>
<td>Some college/Associate’s (2-year) degree = 4 College or Graduate degree = 16</td>
<td>102 (15) Range = 68 - 131</td>
</tr>
<tr>
<td>NH</td>
<td>51 (10) Range = 31-69</td>
<td>Some college/Associate’s (2-year) degree = 4 College or Graduate degree = 16</td>
<td>119 (11) Range = 90 - 137</td>
</tr>
</tbody>
</table>
Study 1: Methods

• Repetition task
• 34 productions of word-initial /t/ and /k/
• Front- and back-vowel contexts
## Study 1: Transcription/Coding

<table>
<thead>
<tr>
<th>Word</th>
<th>Target consonant</th>
<th>Manner transcription</th>
<th>Place transcription</th>
<th>Phonemic accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>tongue</td>
<td>/t/</td>
<td>Stop</td>
<td>[t]</td>
<td>1</td>
</tr>
<tr>
<td>tape</td>
<td>/t/</td>
<td>Stop</td>
<td>other</td>
<td>0</td>
</tr>
<tr>
<td>tooth</td>
<td>/t/</td>
<td>Affricate</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>tickle</td>
<td>/t/</td>
<td>Stop</td>
<td>[t:k]</td>
<td>1</td>
</tr>
<tr>
<td>kitty</td>
<td>/k/</td>
<td>Stop</td>
<td>[k]</td>
<td>1</td>
</tr>
<tr>
<td>kitty</td>
<td>/k/</td>
<td>Stop</td>
<td>[t]</td>
<td>0</td>
</tr>
<tr>
<td>cousin</td>
<td>/k/</td>
<td>Stop</td>
<td>[t:k]</td>
<td>0</td>
</tr>
</tbody>
</table>
Study 1: Production Accuracy

Do children with cochlear implants produce /t/ and /k/ less accurately overall compared to their peers with normal hearing?

Children with CIs
- 24% of productions were inaccurate
  - 54% of errors were on /k/
  - 46% of the errors were on /t/

Children with NH
- 9% of productions were inaccurate
  - 63% of errors were on /k/
  - 37% of the errors were on /t/
Study 1. Error patterns: Voicing errors

**Voicing Errors by Group**

- CI: 27%
- NH: 58%

**Voicing Errors by Group and Consonant**

- CI:
  - Target /k/: 45%
  - Target /t/: 55%
- NH:
  - Target /k/: 42%
  - Target /t/: 58%
Study 1. Error patterns: Manner

Manner Errors by Group

- CI: 25%
- NH: 8%

Affricate Errors by Group

- CI: 44%
- NH: 43%

Affricate Errors by Group and Consonant

- Target /k/:
  - CI: 32%
  - NH: 75%

- Target /t/
Study 1. Error patterns: Place

~50% of all errors were place errors for both groups

- Children with NH had mostly intermediate productions
- Children with CIs had mostly clear substitutions
Study 1: Discussion

- Results for children with NH are consistent with previous literature.
  - Relatively few errors.
  - More errors on /k/ than on /t/.

- Error patterns for children with CIs are best explained by perceptual difficulties.
  - Relatively higher percentage of errors for /t/
  - Relatively lower percentage of voicing errors
Study 2: Dialect mismatch

- Mainstream vs. non-mainstream dialects
  - Social capital
  - Education
  - Prestige
  - Written form
Study 2: Linguistic consequences of poverty

- **In the US**
  - Speaking a non-mainstream dialect
  - African American English
  - Appalachian English

- **What about in Germany?**
  - High vs. Low German
  - Gemischtsprechen (*Mixed Talking*)
  - Türkendeutsch (*Turkish German*)
  - Ghettodeutsch (*Ghetto German*)
  - Kiezdeutsch (*Hood German*)
Study 2: Dialect mismatch

• Dialect mismatch:
  • Home dialect ≠ School dialect

• Example:
  • Dialect of instruction = Mainstream American English (MAE)
  • Home dialect = African American English (AAE)
Study 2: Dialect mismatch and academic achievement

1. Teacher expectations
2. Cognitive resources
3. Direct impact on decoding
Study 2: African American English

- Phonological differences
- Morphosyntactic differences

The students helped themselves to breakfast.

My sister and brother was at that concert.

The boy need more money.
Study 2: Dialect mismatch and academic achievement

- Children with higher dialect density have poorer language and literacy skills.
  - Kindergarten to first grade.
  - First grade to second grade.
- Children who are less able to dialect-shift from AAE to MAE have poorer language and literacy skills.
  - Kindergarten to third grade (spoken language)
  - Third to fifth grade (written language)
Study 2: Non-mainstream dialect use and comprehension of MAE

• Does speaking a non-mainstream dialect of English make it more difficult to understand MAE?
Study 2: Dialect mismatch and comprehension

• **Question**: How well do AAE-speaking children comprehend words that have endings that are contrastive in MAE but not in AAE? (Edwards et al., 2015)

• **Participants**
  • 105 African American children
  • 4- to 8-year-olds
  • from low-SES families (mostly)
Study 2: Methods

STIMULI

- **Phonological contrast:**
  - Final consonant cluster deletion
  - *goal* vs. *gold*
  - */gol/* is ambiguous in AAE, but not in MAE

- **Morphological contrast:**
  - Plural marking
  - Plural is optional in AAE (*Fifty cent*)
  - *cat* vs. *cats*

- Stimuli recorded in AAE and MAE

<table>
<thead>
<tr>
<th>AAE</th>
<th>MAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal please</td>
<td>Gold please</td>
</tr>
<tr>
<td>(AAE)</td>
<td>(AAE)</td>
</tr>
<tr>
<td>Goal please</td>
<td>Gold please</td>
</tr>
<tr>
<td>(MAE)</td>
<td>(MAE)</td>
</tr>
</tbody>
</table>
PROCEDURE

• **Training phase:**
  • Each target picture first named in AAE.
  • Child asked to name each target picture (*say _____ please*).

• **Test phase:**
  • Point to _______ (in MAE).

“Point to goal please”

Distracter  Filler  Target
Study 2: Additional measures

- Vocabulary size:
  - Expressive vocabulary: EVT-2
  - Receptive vocabulary: PPVT-4
- Maternal education level
  - Multiple choice question on questionnaire
- Dialect density
  - Language sample
  - Frequency of non-mainstream dialect features
Study 2: Dialect density

• Dialect density
  • Measured from 50-utterance recorded language sample.
  • Sample elicited in conversation with a native AAE speaker.
  • Both morphosyntactic and phonological dialect features coded by a native AAE-speaking adult.
Study 2: Coding of AAE features

where dem people finna sit?

tense copula/“dem” for “them”/“finaa”/
“them” for “those”
### Where dem people fitna sit?

**Gloss:** *Where are those people going to sit?*

<table>
<thead>
<tr>
<th>Morphosyntactic Features</th>
<th>Explanation</th>
<th>Example from sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zero copula</strong></td>
<td>is, <em>are</em>, am, and other forms of the verb <em>to be</em> variably included</td>
<td><em>Where ___ those (dem)</em></td>
</tr>
<tr>
<td><strong>Undifferentiated pronoun case</strong></td>
<td>Nominative, <em>objective</em>, and demonstrative cases of pronouns used interchangeably</td>
<td><em>Those (dem) people</em></td>
</tr>
<tr>
<td><strong>Fitna/sposeta/bouta</strong></td>
<td>Abbreviated forms coding imminent action</td>
<td><em>Fitna sit.</em></td>
</tr>
</tbody>
</table>

**Phonological feature**

<table>
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<tr>
<th>Explanation</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>/t/ and /d/ substitute for /ð/ and /θ/ in prevocalic position</td>
<td>/dɛm/ for <em>them</em></td>
</tr>
</tbody>
</table>
Study 2: Dialect density

• Dialect density = number of dialect features/total number of words.

• Dialect density results:
  • range = 0 (3 children) to .28
  • mean = .06.

• Only 85 children (out of 105) produced analyzable language samples.
Study 2: Results

Mean percent correct by condition and contrast (SD in parentheses)

<table>
<thead>
<tr>
<th></th>
<th>Singleton Consonant (Ambiguous Condition)</th>
<th>Consonant Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonological contrast</td>
<td>66 (14)</td>
<td>75 (15)</td>
</tr>
<tr>
<td>Morphological contrast</td>
<td>62 (31)</td>
<td>83 (16)</td>
</tr>
</tbody>
</table>

- Ambiguous (in AAE) conditions were the most difficult.
- Accuracy was predicted by:
  - Expressive vocabulary size
  - Dialect density
Study 2: MAE comprehension: Results

\[ R^2 = .27 \]

\[ R^2 = .28 \]
Study 2: Structural equation modeling

- What are the relationships among the measures that predict comprehension of MAE?

- Divided variables into:
  - Input variables
  - Mediating variables
Study 2: Structural equation model

Age

Receptive vocabulary

Expressive vocabulary

MAE lexical comprehension

Dialect density

SES
Study 2: Discussion

• Non-mainstream dialect speakers did have difficulty understanding MAE.
• Both expressive vocabulary and dialect density independently predicted comprehension of MAE.
• Does it make sense to teach children how to dialect shift between the home and school dialect when they enter school?
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