The Influence of Word Characteristics on the Vocabulary of Children with Cochlear Implants

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Introduction

• Studies of typically developing normal hearing children show that knowledge of language structure influences which words are learned
• Specific measures of language structure:
  - Word length - the number of sounds in a word
  - Word frequency - the number of times a word is heard
  - Neighborhood density - the number of known words that sound similar to a given word
  - Phonotactic probability - the likelihood of occurrence of a sound sequence
• Typically developing normal hearing children tend to learn words with:
  - Few phonemes
  - High frequency
  - High density
  - Low probability

Why are children with CIs of particular interest?

• The input they receive differs from normal hearing children, potentially affecting which words are learned versus which words are not learned.

Research Questions

• For children with CIs do the known words differ from the unknown words on any of the word characteristics?
• Do these effects vary across groups of children with CIs differing in language outcomes?

Methods

• A retrospective analysis of a subset of data from the Colorado longitudinal study of hearing loss (Yoshinaga-Itano, Baca, & Sedey, 2010)
• Participants: 3 Groups based on children’s language outcomes from infancy to age 7
  - Gap closer: children whose language improved to an age-appropriate level
  - Age equivalent: children whose language was age-appropriate throughout the study
  - Delayed: children whose language was below age expectations at age 7
• Data:
  - CDIs at pre-CI and post-CI
  - EOWPVT-3 at post-CI and latest post-CI

Results

• CDIs at pre-CI and post-CI
  - Significant main effect of response on word length: Correct words are significantly shorter than incorrect words.
  - Significant main effect of response on phonotactic probability: Correct words are significantly rarer than incorrect words.
  - EOWPVT-3 at post-CI and latest post-CI
  - Significant main effect of response on word length: Correct words are significantly shorter than incorrect words.
  - Significant main effect of response on phonotactic probability: Correct words are significantly shorter than incorrect words.

Conclusions and Discussion

• Summary of Word Characteristics of Known Words by Children with CIs for Each Test

<table>
<thead>
<tr>
<th>Word Characteristics</th>
<th>CDIs pre-CI and post-CI</th>
<th>EOWPVT-3 post-CI and latest post-CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word length</td>
<td>Short &gt; Long*</td>
<td>Short &gt; Long*</td>
</tr>
<tr>
<td>Word frequency</td>
<td>No significant effect</td>
<td>Frequent &gt; Infrequent at post-CI*</td>
</tr>
<tr>
<td>Neighborhood density</td>
<td>No significant effect</td>
<td>Dense &gt; Sparse*</td>
</tr>
<tr>
<td>S Phonotactic probability</td>
<td>Rare &gt; Common*</td>
<td>No significant effect</td>
</tr>
<tr>
<td>B Phonotactic probability</td>
<td>Rare &gt; Common*</td>
<td>No significant effect</td>
</tr>
</tbody>
</table>

• Group Difference No No

The results of this study are consistent with those of previous studies although not all of the word characteristics were influential at the same test time.
• Word length: Effects of word length were robust appearing at all time points tested.
• Word frequency: Children with CIs seem to learn words with higher frequency better than low frequency, possibly aided by the multiple exposures.
• Neighborhood density: Dense characteristic seems to emerge relatively late compared to children with normal hearing (e.g., Hollich et al., 2002: 17-months old; Storkel, 2004, 2009): 16-30 months old). This late high-density advantage might indicate delayed lexical acquisition in children with HL.
• Phonotactic probability: As children with CIs learn more words, the effect of phonotactic probability may decrease over time.
• Group difference: Although no group differences were found in word characteristics of known words by children with CIs, there were medium and large effect sizes in the interaction of Group and Response for word frequency, neighborhood density, and phonotactic probability for positional segmental at pre- and post-CI, and for neighborhood density and two measures of phonotactic probability at post- and latest post-CI, indicating the possibility for group differences in larger samples.

References