Phonological and lexical characteristics of sound productions by preschool children

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November 22, 2004 Lee & Storkel

Phonological Acquisition
- Influenced by phonological and lexical characteristics.
- Phonological variability: an acquired sound used correctly in some words but not others.
- What are the characteristics of the words that are vulnerable to production accuracy?

Phonological Characteristic
- Phonotactic Probability
  - Sound characteristic
  - The likelihood of occurrence of a particular sound or sound sequences in a given language (Vitevitch & Luce, 1999)
    - e.g., "sit" /sɪt/
  - High phonotactic probability → "sit" "coat"
  - Low phonotactic probability → "these" "watch"

Lexical characteristic
- Word frequency
  - Characteristic of whole word forms
  - The number of times that a word occurred in a language (Storkel, 2004).
    - High frequency → "these" (1,573 in 1 million of adult written words)
    - Low frequency → "sit" (67 in 1 million of adult written words)

Lexical Characteristic
- Neighborhood density
  - Characteristic of whole word forms
  - The number of words that are phonemically similar to a given word based on a one phoneme substitution, addition, or deletion (Luce & Pisoni, 1998).
    - e.g., "sit" → "sip", "spit", "it"
  - High neighborhood density: "sit" (N = 24)
  - Low neighborhood density: "these" (N = 9)

Backgrounds
- TD children recognized and produced high probability sounds more rapidly and accurately in nonwords (Edwards, Beckman, & Munson, 2004)
- TD children produced high frequency and high density in real words more accurately (Newman & German, 2002, 2005).
- No studies of phonotactic probability, word frequency, neighborhood density in real words by children with phonological delays.
Purpose of the study

- To explore influences of phonological and lexical characteristics on sound production by typically developing children and children with phonological delays.

Participants

- Selected from a larger study
- Examined PD kids with 17 – 45% accuracy on a given sound.
- Identified 9 kids for 6 emerging sounds (δ, ŋ, t, dʒ, f, θ)
- Matched on accuracy of that sound to a TD child.
- For that sound, examined characteristics of accurate and inaccurate production.

<table>
<thead>
<tr>
<th></th>
<th>TD (n=9)</th>
<th>PD (n=9)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>S</td>
</tr>
<tr>
<td>Age (months)</td>
<td>44</td>
<td>5.2</td>
</tr>
<tr>
<td>GFTA Percentile</td>
<td>39</td>
<td>10.2</td>
</tr>
<tr>
<td>PPVT-III Percentile</td>
<td>60</td>
<td>14</td>
</tr>
<tr>
<td>EVT Percentile</td>
<td>44</td>
<td>22</td>
</tr>
</tbody>
</table>

Measures

- Phonotactic probability, frequency, neighborhood density were computed using an on-line child calculator (Jill, Storkel, & Kieweg, 2008).
- Patterns for accurate and inaccurate production were compared across groups.

Criteria for interpretation of significance

- Meeting both criteria
  - SEM criterion: Mean difference between accurate versus inaccurate production greater than SEM (Standard Error of Measurement).
  - Subject criterion: 5/9 subjects in the group show the same trend (i.e., low or high advantage for accurate production).

RESULT: Phonotactic Probability
**TD: High Phon Prob Effect**

**PD: Variable Phon Prob Effect**

* 0.0023

*0.0018

-0.0020

-0.0010

0.0000

0.0010

0.0020

0.0030

0.0040

0.0050

0.0060

0.0070

0.0080

0.0090

0.0100

**Group Mean**

**Mean Phonotactic Probability Difference**

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**TD: 8/9 High Phon Prob Advantage**

**PD: 4/9 High Phon Prob Advantage**

5/9 Low Phon Prob Advantage

-0.0150

-0.0100

-0.0050

0.0000

0.0050

0.0100

0.0150

0.0200

**PD Subjects**

**Phonotactic Probability Difference**

**Discussion: Phonotactic Probability**

- High phonotactic probability effect in TD
  - Consistent with the previous studies in nonword repetition tasks (Edwards, Beckamn, & Munson, 2004; Munson, Edwards, & Beckman, 2005).
  - Attributed to the predictability of phonological sequence and frequency (Storkel & Rogers, 2000).
  - Facilitate the creation of association between a new lexical representation and the newly acquired phonological representation.

- Variability in phon prab effect in PD
  - ½ group performs similar to TD. (High effect)
    - Attributed to the predictability of phonological sequence and frequency (Storkel & Rogers, 2000).
  - ½ group shows opposite effect. (Low effect)
    - Attributed to uniqueness of sound sequences in low phonotactic probability words.
    - May imply their difficulty distinguishing common sound sequence words from other similar forms.

**RESULT: Frequency**
TD: Variable Frequency Effect
PD: Low Frequency Effect

0.1214
* -0.1740
-0.4000
-0.3000
-0.2000
-0.1000
0.0000
0.1000
0.2000
0.3000
1

Group Mean

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TD: 4/9 High Frequency Advantage
5/9 Low Frequency Advantage

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PD: 6/9 Low Frequency Advantage

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Discussion: Frequency
- Variable frequency effect in TD
  - ½ High frequency advantage
    - Attributed to the frequent activation in recognizing, accessing, retrieving, or producing with high frequency words (Gierut, et al., 1999).
    - For the sake of communicative message (Macken & Ferguson, 1983)
  - ½ Low frequency advantage
    - Attributed to the flexibility of underlying lexical representation in infrequent words (vulnerable to sound change)

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Discussion: Frequency
- Low frequency effect in PD
  - Attributed to the flexibility of underlying lexical representation in infrequent words (vulnerable to sound change).
  - More likely to show sound change in less well practiced environments.
  - Unwillingness to attempt to new sounds in a variety of phonological and lexical contexts.

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RESULT: Neighborhood Density
High Neighborhood Density Effect in both groups

<table>
<thead>
<tr>
<th>Group Mean Difference</th>
<th>Density Difference</th>
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<tr>
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</tr>
<tr>
<td>1.0000</td>
<td>2.0000</td>
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<tr>
<td>1.5000</td>
<td>2.5000</td>
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<td>2.0000</td>
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</table>

TD: 7/9 High Density Advantage

<table>
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<tr>
<th>Density Difference</th>
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<tbody>
<tr>
<td>0.0000</td>
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<td>1.0000</td>
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<tr>
<td>2.0000</td>
</tr>
<tr>
<td>3.0000</td>
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<tr>
<td>4.0000</td>
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</table>

PD: 5/9 High Density Advantage

<table>
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<th>Density Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.0000</td>
</tr>
<tr>
<td>-2.0000</td>
</tr>
<tr>
<td>-1.0000</td>
</tr>
<tr>
<td>0.0000</td>
</tr>
<tr>
<td>1.0000</td>
</tr>
</tbody>
</table>

Discussion: Neighborhood Density

- High neighborhood density effect in both groups
- Similar to past study (Stokel & Gierut, 2002).
- The more phonologically detailed representations in high density neighborhoods.
- Facilitate association between an existing lexical representations and new lexical representations.
- A general property of sound acquisition.

SUMMARY

- Phonotactic Probability
  - High phonotactic probability effect in TD
  - Variable phonotactic probability effect in PD
- Frequency
  - Variable frequency effect in TD
  - Low frequency effect in PD
- Neighborhood Density
  - High density effect in both TD and PD groups

CONCLUSION

- The findings from this study suggest that influences of phonological and lexical properties on sound productions may vary across TD and PD children.
Acknowledgements

• DC 06545
• Word & Sound Learning Laboratory
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Thank You!