The effect of homonymy on learning correctly articulated versus misarticulated words

Holly Storkel¹, Junko Maekawa¹, & Andrew Aschenbrenner²

¹University of Kansas; ²Washington University-St. Louis

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Phonology & Lexicon

• Phonology
  – Sound system of the language

• Lexicon
  – Words in the language
  – Each word has (at least):
    • Lexical representation (e.g., /wɛb/ for ‘web’)
    • Semantic representation (e.g., ‘structure that a spider spins to catch prey’ for ‘web’)

• Phonology & lexicon interact (e.g., Munson, 2001; Edwards, et al., 2004; Storkel, 2001, 2003; Storkel & Rogers, 2000)
Interplay Between Phonology & Lexicon: Impact of Articulation on Word Learning

Correct Articulation, e.g., [weit] for target word /weit/, “wait”

- Presumably stronger phonological support for word learning

Misarticulation, e.g., [weɪt] for target word /reɪt/, “rate”

- Presumably weaker phonological support for word learning

- Correctly articulated words learned better than misarticulated words in very young children (Schwartz & Leonard, 1982)

- What happens in older (i.e., preschool) children?
Role of Homonymy: Correct Articulation

No Homonymy,
e.g, “mom” meaning person who raised
or gave birth to a child

- 1 lexical representation:
  1 semantic representation

Homonymy,
e.g, “bank” meaning financial institution
& “bank” meaning land near river

- 1 lexical representation:
  2+ semantic representations

- Learning the second meaning of a homonym may be faster than
  learning a non-homonym (Storkel & Maekawa, 2005)
Current Study

• Does homonymy facilitate or impede learning of correctly articulated words?

• Does homonymy facilitate or impede learning of misarticulated words?
### Word Learning Scenario

<table>
<thead>
<tr>
<th>Homonymy</th>
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<th>Misarticulation (OUT) Target /v/ produced as [v]</th>
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<td>No Homonymy</td>
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### No Homonymy

- **This is a /moʊb/ (novel word)**
  - Child says: /moʊb/ (novel word)
  - Learn semantic representation
  - Learn lexical representation
  - **Stronger phonological support**

- **This is a /væp/ (novel word)**
  - Child says: [bæp] (novel word)
  - Learn semantic representation
  - Learn lexical representation
  - **Weaker phonological support?**

### Homonymy

- **This is a /mʌd/ (known word ‘mud’)**
  - Child says: /mʌd/ (known word)
  - Learn semantic representation
  - **Stronger phonological support**

- **This is a /vɛd/ (novel word)**
  - Child says: [bɛd] (known word, ‘bed’)
  - Learn semantic representation
  - “Use” existing lexical representation? /bɛd/ 
  - Learn lexical representation? /vɛd/
  - **Weaker phonological support?**

### Prediction

- **Homonymy facilitates word learning**

- Homonymy facilitates learning (/bɛd/)?
- Homonymy has no effect (/vɛd/)?
- Homonymy slows learning (confusion)?
Additional Issue

• Does word frequency influence the effect of homonymy?

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Last Question

• Does word frequency influence the effect of homonymy?

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Methods
Participants

• 29 3- and 4-year-old typically developing children
  – \( M = 3 \) years; 9 months, \( SD = 0 \); 5, range 3; 0 – 4; 9
• Passed a hearing screening
• Standard Scores on Language Tests WNL
  – Phonology: \( M = 98 \), \( SD = 5 \), range = 89 – 106
  – Receptive vocab: \( M = 109 \), \( SD = 9 \), range = 91 – 134
  – Expressive vocab: \( M = 105 \), \( SD = 13 \), range = 78 – 133
Independent Variable: Articulation

• Test production of potential
  – IN sounds (/m n p b t k/)
  – OUT sounds (/v θʃ tʃ l r/)

• IN sounds
  – 100% accurate in word-initial position
  – 99% accurate in word-final position

• OUT sounds
  – 4% accurate in word-initial position
  – 12% accurate in word-final position
Independent Variable: Homonymy

• For each IN & OUT sound
  – Novel sound sequence (no homonymy) selected
  – Known sound sequence (homonymy) selected
    • Independent Variable: Word Frequency
      – Low frequency
      – High frequency
Example Stimuli:
38% of Participants Received This Stimulus Set

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<td>/θʌt/ ([fʌt]), /θid/ ([fid]) /ræp/ ([wæp]), /rʊn/ ([wʊn])</td>
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- 6 stimulus sets constructed (different IN/OUT sounds)
  - 21% /m b ʃ(s) r(w)/ set
  - 21% /m k v(b) r(w)/ set
  - 7% /n t ɔ(f) l(w)/ set
  - 7% /n k ɔ(s) r(w)/ set
  - 3% /m b ʃ(s) l(w)/ set
CVC – Referent Pairings

• 16 CVCs paired with novel objects from 4 categories:
  – Pets – IN Non-Homonym, IN Homonym, OUT Non-Homonym, OUT Homonym
  – Toys – IN Non-Homonym, IN Homonym, OUT Non-Homonym, OUT Homonym
  – Candy – IN Non-Homonym, IN Homonym, OUT Non-Homonym, OUT Homonym
  – Music – IN Non-Homonym, IN Homonym, OUT Non-Homonym, OUT Homonym
Procedures

• Baseline: Picture Naming
• Training 1: 8 exposures + 2 imitation attempts
• Test 1: Picture Naming
• Training 2: 16 cumulative exposures
• Test 2: Picture Naming
• Training 3: 24 cumulative exposures
• Test 3: Picture Naming
• Training 4: 32 cumulative exposures
• Test 4: Picture Naming
• New Day – Test 5: Picture Naming
Analysis

• Dependent Variable = accuracy
  – Correct = all target sounds correct (except OUT)
  – Incorrect

• Multilevel Modeling (MLM)
  – Cross-classified model
    • Random effects of items & participants
  – Logistic MLM
    • Dependent Variable = Binary
Results

• Significant Random Effects
  – Participants, $\chi^2 (1) = 49.85, p < .001$
  – Items, $\chi^2 (1) = 304.71, p < .001$

• Significant Fixed Effects
  – Misarticulation (IN, OUT), $F (1, 2164) = 6.05, p = .01$
  – Homonymy (known, novel), $F (1, 2164) = 14.20, p < .001$
  – Misarticulation x Homonymy, $F (1, 2164) = 5.74, p = .02$
  – Test (test 1, 2, 3, 4, 5: retention), $F (4, 2164) = 3.96, p < .01$
Does homonymy facilitate or impede learning of correctly articulated words?
Baseline Test 1 Test 2 Test 3 Test 4 Test 5:
Retention
Proportion Correct

Correct Articulation: No Homonymy
Correct Articulation: Homonymy
Misarticulation: No Homonymy
Misarticulation: Homonymy
Does homonymy facilitate or impede learning of correctly articulated words?

Answer: Homonymy facilitates learning of correctly articulated words
Does homonymy facilitate or impede learning of misarticulated words?
Baseline Test 1 Test 2 Test 3 Test 4 Test 5:
Retention Proportion Correct

Correct Articulation: No Homonymy
Correct Articulation: Homonymy
Misarticulation: No Homonymy
Misarticulation: Homonymy
Does homonymy facilitate or impede learning of misarticulated words?

Answer: Homonymy does not facilitate or impede learning of misarticulated words
## Articulation x Homonymy Conclusion

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### Conclusion
- **Homonomy facilitates word learning**
- **Confirms Prediction**
- **Homonomy has no effect**
Does word frequency influence the effect of homonymy?

Significant effect of homonymy for correctly articulated words only

So, analysis for this last question focuses on correctly articulated words only
Analysis & Results

• Cross-classified logistic MLM with random effects of participants & items

• Significant fixed effects
  – Frequency (low, high), $F (1, 520) = 6.56, p = .01$
Does word frequency influence the effect of homonymy?

Answer: Yes

Second meaning of high frequency learned better than second meaning of low frequency, which is learned better than a new meaning and form (i.e., novel word)
Word Frequency Conclusion

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• Thanks to: Word & Sound Learning Lab Staff; Daniel Bontempo (statistical analysis); Participating children, families, preschools

• Contact Information: Holly L. Storkel hstorkel@ku.edu www.ku.edu/~wrdlrng