

# The effect of homonymy on learning correctly articulated versus misarticulated words

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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, [weit] for target word /reit/, “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

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

## Homonymy,

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




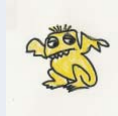
- 1 lexical representation:  
2+ semantic representations

# Current Study

- Does homonymy facilitate or impede learning of correctly articulated words?
- Does homonymy facilitate or impede learning of misarticulated words?



# Word Learning Scenario

|             | Correct Articulation (IN)<br>Target /m/ produced as [m]                                                                                                            | Misarticulation (OUT)<br>Target /v/ produced as [v]                                                                                                                   |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No Homonymy | <p>This is a /moʊb/ (novel word)</p>  <p>Child says: /moʊb/ (novel word)</p>      | <p>This is a /væp/ (novel word)</p>  <p>Child says: [bæp] (novel word)</p>         |
| Homonymy    | <p>This is a /mʌd/ (known word 'mud')</p>  <p>Child says: /mʌd/ (known word)</p> | <p>This is a /vɛd/ (novel word)</p>  <p>Child says: [bɛd] (known word, 'bed')</p> |

# Word Learning Scenario

|             | Correct Articulation (IN)<br>Target /m/ produced as [m]                                                                                                                                                  | Misarticulation (OUT)<br>Target /v/ produced as [v]                                                                                                                                                                                                                          |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No Homonymy | <p>This is a /moʊb/ (novel word)<br/>Child says: /moʊb/ (novel word)</p> <p><i>Learn semantic representation</i><br/><i>Learn lexical representation</i></p> <p><i>Stronger phonological support</i></p> | <p>This is a /væp/ (novel word)<br/>Child says: [bæp] (novel word)</p> <p><i>Learn semantic representation</i><br/><i>Learn lexical representation</i></p> <p><i>Weaker phonological support?</i></p>                                                                        |
| Homonymy    | <p>This is a /mʌd/ (known word 'mud')<br/>Child says: /mʌd/ (known word)</p> <p><i>Learn semantic representation</i></p> <p><i>Stronger phonological support</i></p>                                     | <p>This is a /vɛd/ (novel word)<br/>Child says: [bɛd] (known word, 'bed')</p> <p><i>Learn semantic representation</i><br/><i>"Use" existing lexical representation? /bɛd/</i><br/><i>Learn lexical representation? /vɛd/</i></p> <p><i>Weaker phonological support ?</i></p> |
| Prediction  | Homonymy facilitates word learning                                                                                                                                                                       | Homonymy facilitates learning (/bɛd/)?<br>Homonymy has no effect (/vɛd/)?<br>Homonymy slows learning (confusion)?                                                                                                                                                            |

# Additional Issue

- Does word frequency influence the effect of homonymy?

|                      | Correct Articulation (IN)<br>Target /m/ produced as [m]              |
|----------------------|----------------------------------------------------------------------|
| No Homonymy          | This is a /moʊb/ (novel word)<br>Child says: /moʊb/ (novel word)     |
| Homonymy<br>Low Freq | This is a /mʌd/ (known word 'mud')<br>Child says: /mʌd/ (known word) |
| Hi Freq              | This is a /mam/ (known word 'mom')<br>Child says: /mam/ (known word) |



# Last Question

- Does word frequency influence the effect of homonymy?

|                      | Correct Articulation (IN)<br>Target /m/ produced as [m]              |
|----------------------|----------------------------------------------------------------------|
| No Homonymy          | This is a /moʊb/ (novel word)<br>Child says: /moʊb/ (novel word)     |
| Homonymy<br>Low Freq | This is a /mʌd/ (known word 'mud')<br>Child says: /mʌd/ (known word) |
| Hi Freq              | This is a /mam/ (known word 'mom')<br>Child says: /mam/ (known word) |

# 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 θ ʃ 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

|                      | Correct Articulation (IN)<br>Target /n/ produced as [n]<br>Target /p/ produced as [p] | Misarticulation (OUT)<br>Target /θ/ produced as [f]<br>Target /r/ produced as [w]      |
|----------------------|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| No Homonymy          | /noʊk/, /num/<br>/pʌd/, /pɪb/                                                         | /θʌt/ ([fʌt]), /θɪd/ ([fɪd])<br>/rɑp/ ([wɑp]), /run/ ([wun])                           |
| Homonymy (frequency) | 'nip' (low), 'knock' (high)<br>'pad' (low), 'pot' (high)                              | /θɛd/ ('fed' - low), /θæt/ ('fat' - high)<br>/rɛb/ ('web' - low), /rɪn/ ('win' - high) |

- 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 θ(f) l(w)/ set
  - 7% /n k θ(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

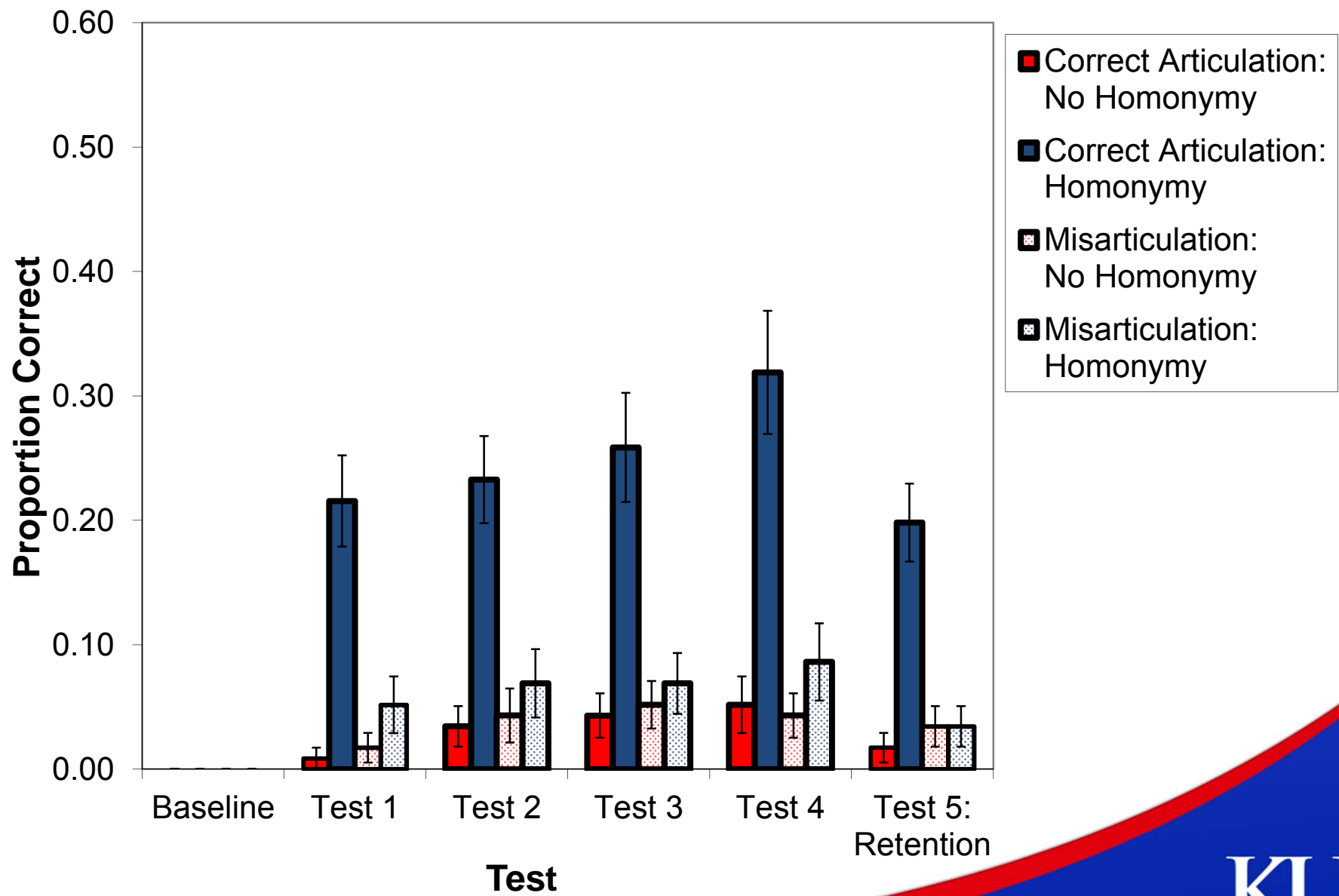
- Baseline: Picture Naming
- Training 1: 8 exposures + 2 imitation attempts
- Test 1: Picture Naming
- Training 2: 16 cumulative exposures
- Test 2: Picture Naming
- Training 3: 24 cumulative exposures
- Test 3: Picture Naming
- Training 4: 32 cumulative exposures
- Test 4: Picture Naming
- New Day –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

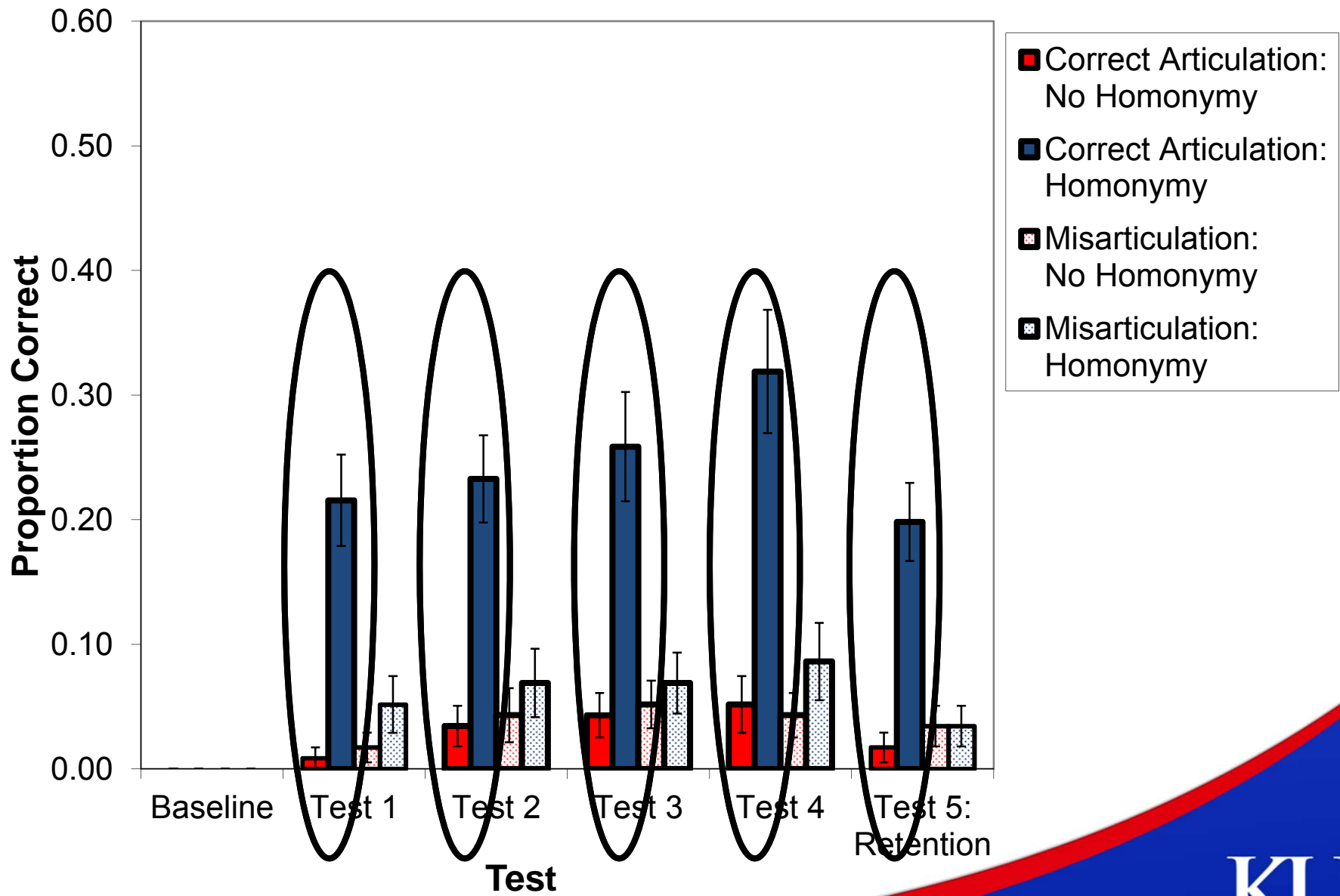
# Results

- 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?

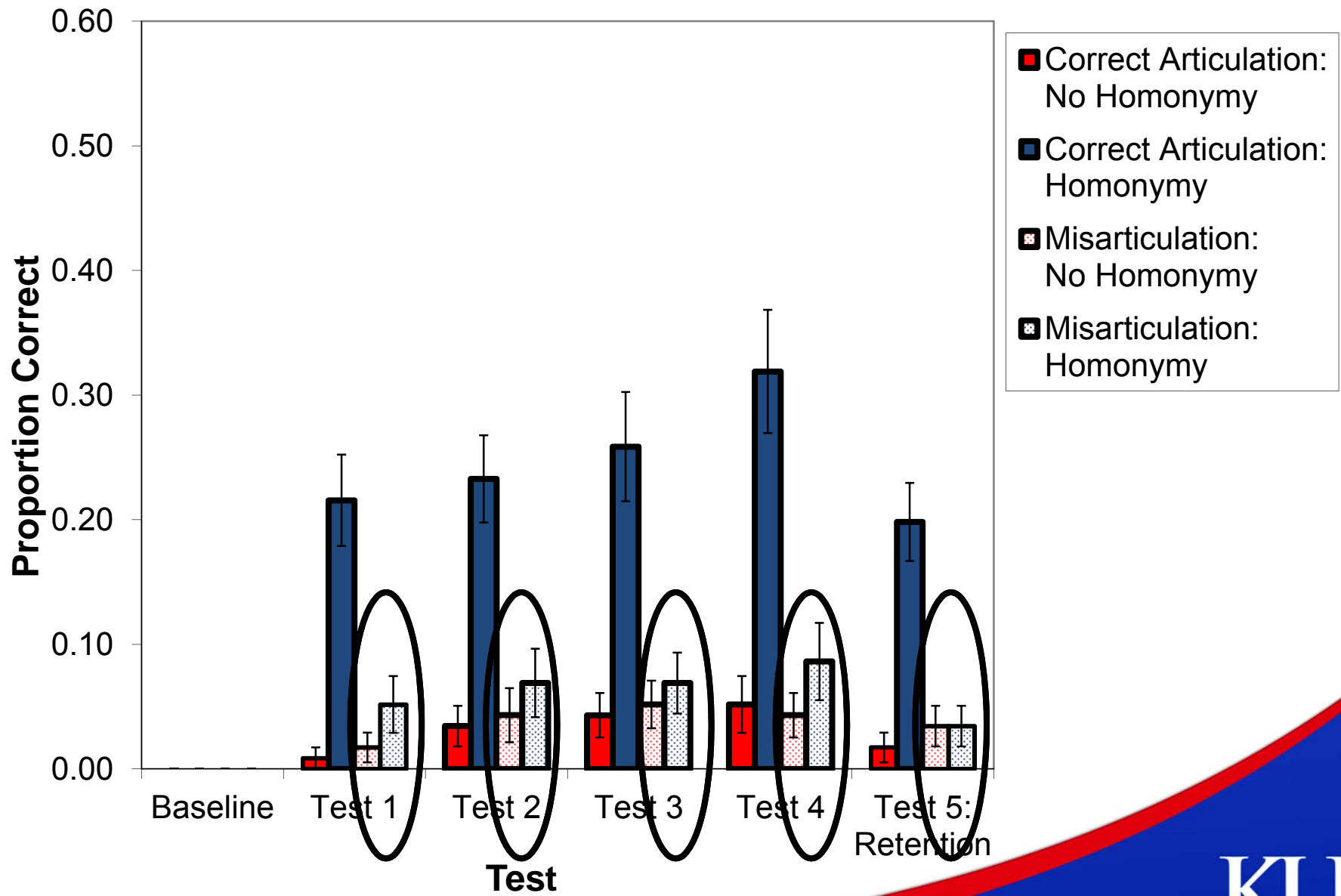




Does homonymy facilitate or impede learning of correctly articulated words?

Answer: Homonymy facilitates learning of correctly articulated words

Does homonymy facilitate or  
impede learning of  
misarticulated words?



# Does homonymy facilitate or impede learning of misarticulated words?

Answer: Homonymy does not  
facilitate or impede learning of  
misarticulated words

# Articulation x Homonymy Conclusion

|             | Correct Articulation (IN)<br>Target /m/ produced as [m]                                                                                             | Misarticulation (OUT)<br>Target /v/ produced as [v]                                                                                                      |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| No Homonymy | This is a /moʊb/ (novel word)<br>Child says: /moʊb/ (novel word)<br><br><i>Learn semantic representation</i><br><i>Learn lexical representation</i> | This is a /væp/ (novel word)<br>Child says: [bæp] (novel word)<br><br><i>Learn semantic representation</i><br><i>Learn lexical representation</i>        |
| Homonymy    | This is a /mʌd/ (known word 'mud')<br>Child says: /mʌd/ (known word)<br><br><i>Learn semantic representation</i>                                    | This is a /vɛd/ (novel word)<br>Child says: [bɛd] (known word, 'bed')<br><br><i>Learn semantic representation</i><br><i>Learn lexical representation</i> |
| Conclusion  | Homonymy facilitates word learning<br>Confirms Prediction                                                                                           | Homonymy has no effect                                                                                                                                   |



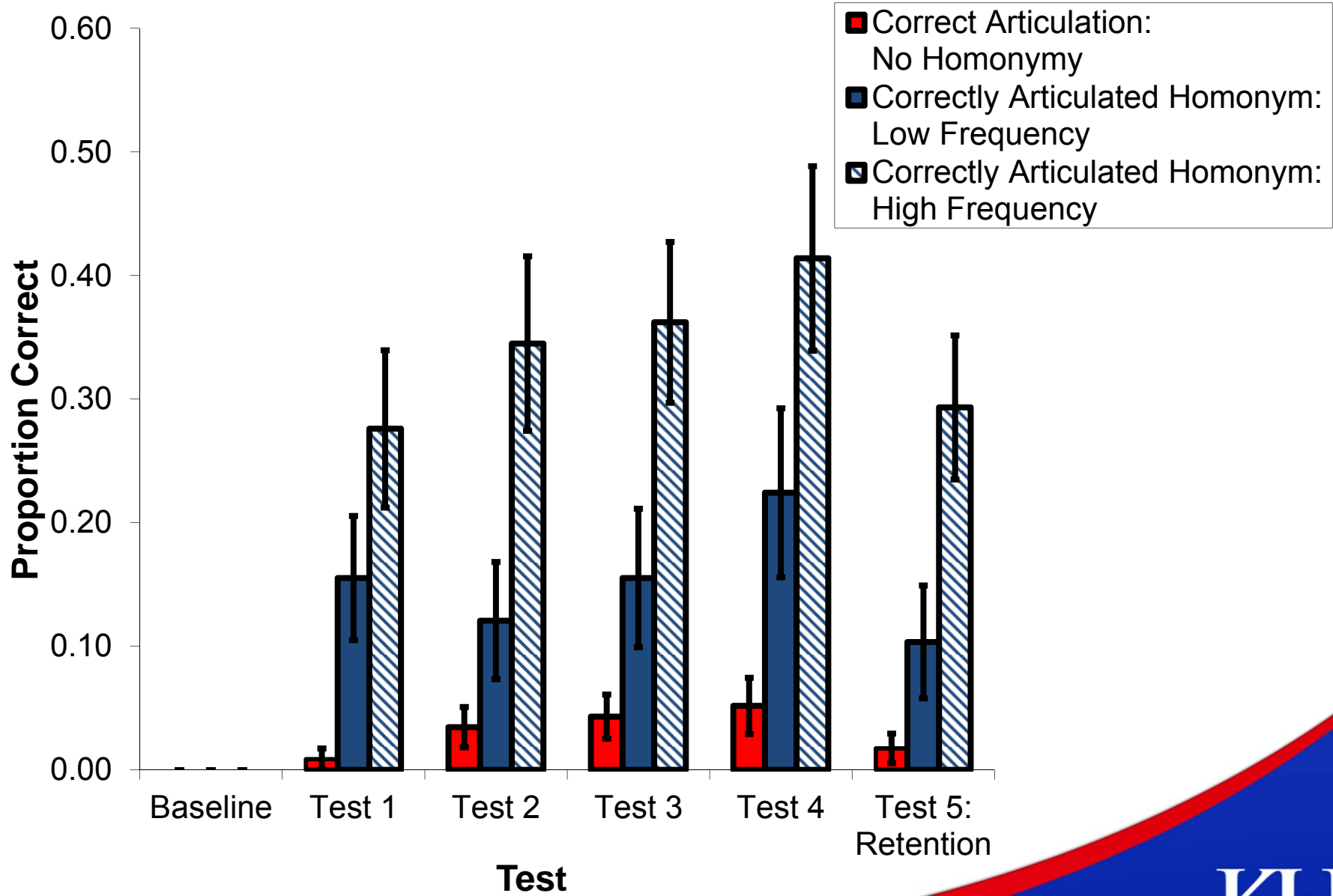
# Does word frequency influence the effect of homonymy?

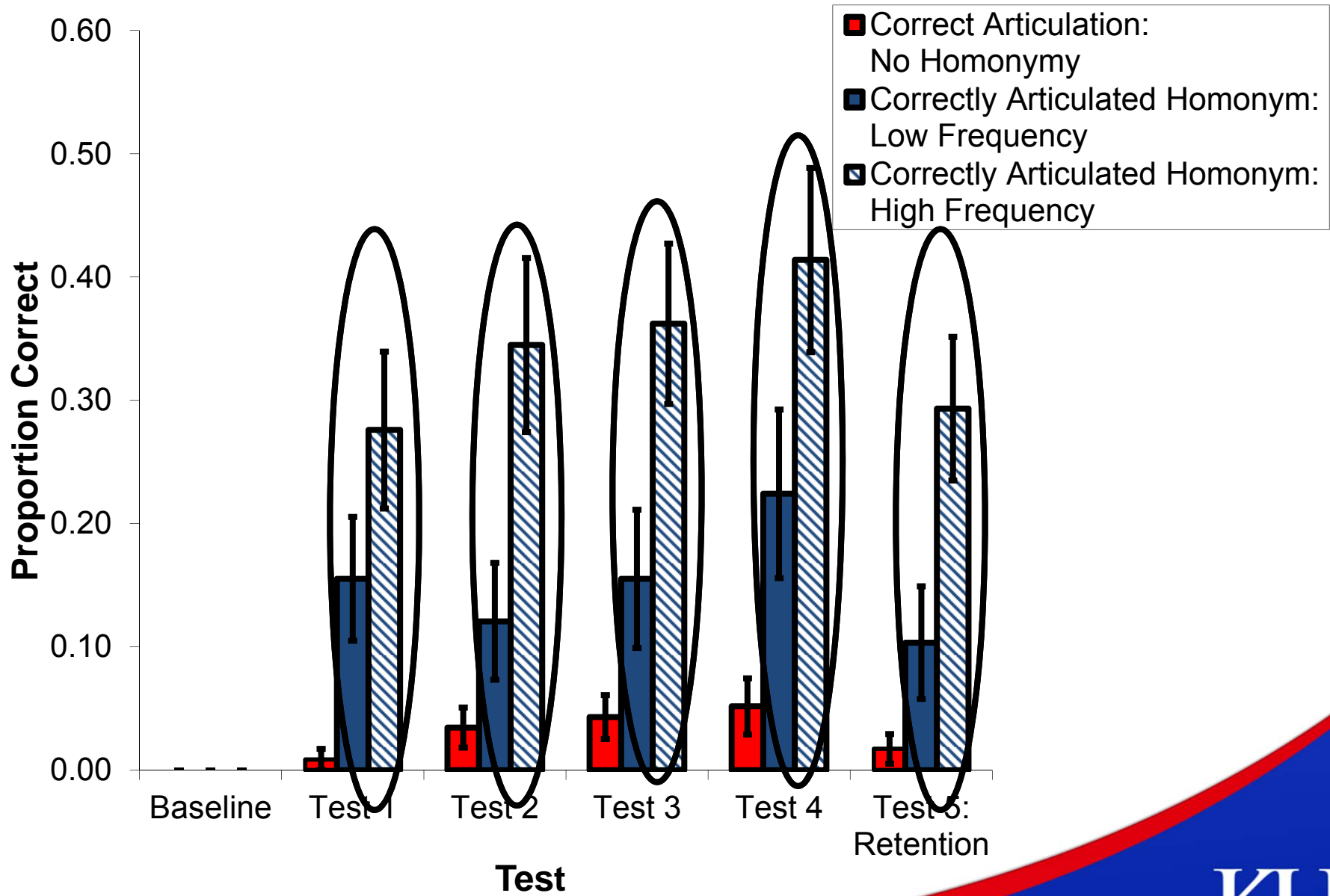
Significant effect of homonymy for correctly  
articulated words only

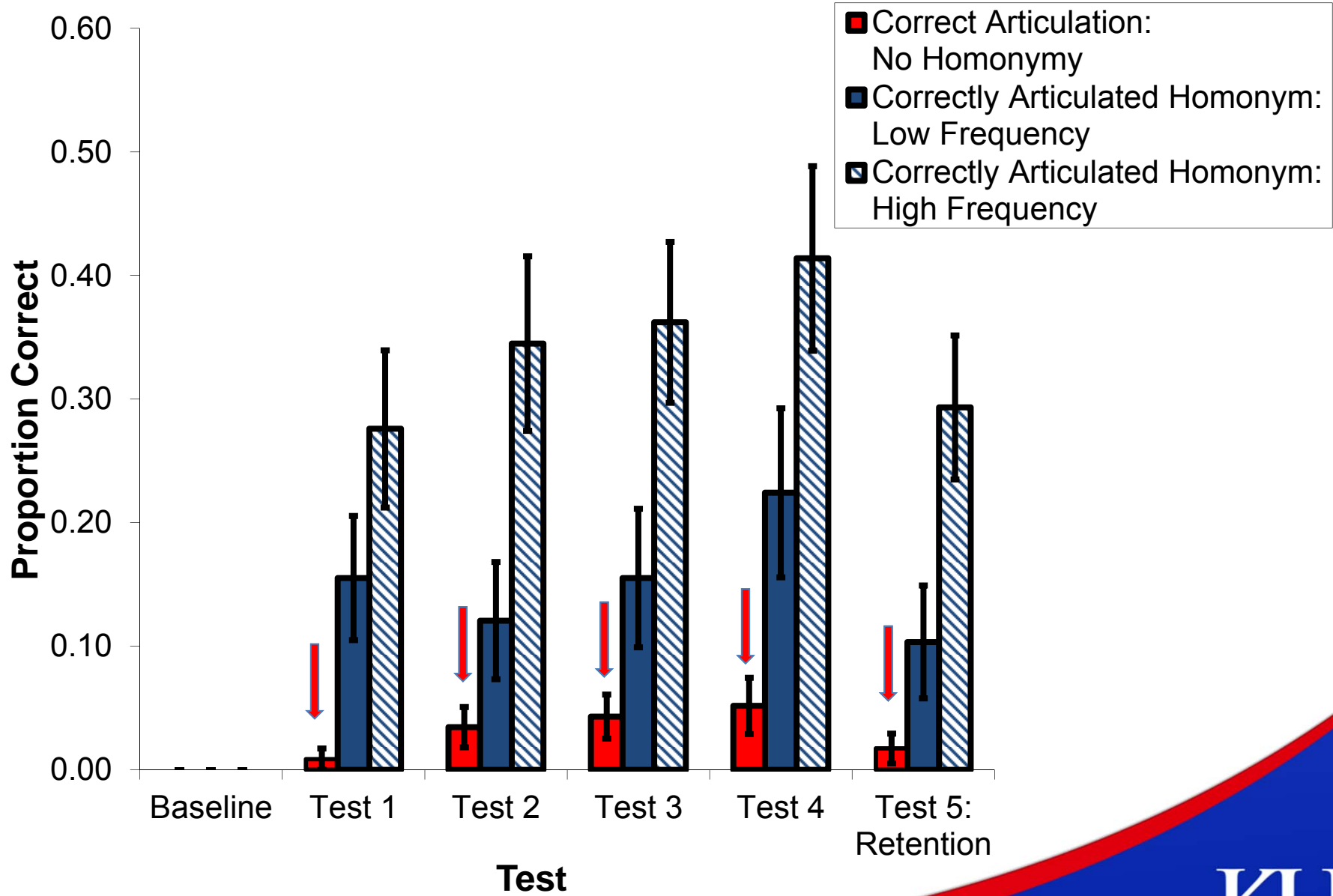
So, analysis for this last question focuses on  
correctly articulated words only

# 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

|             |           | Correct Articulation (IN)<br>Target /m/ produced as [m]                                                                                              |
|-------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| No Homonymy |           | This is a /moʊb/ (novel word)<br>Child says: /moʊb/ (novel word)<br><i>Learn semantic representation</i><br><i>Learn lexical representation</i>      |
| Homonymy    | Low Freq  | This is a /mʌd/ (known word 'mud')<br>Child says: /mʌd/ (known word)<br><i>Learn semantic representation</i><br><i>Update lexical representation</i> |
|             | High Freq | This is a /mam/ (known word 'mom')<br>Child says: /mam/ (known word)<br><i>Learn semantic representation</i>                                         |

# Thank you!

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