The effect of homonymy on learning correctly articulated versus misarticulated words

Holly Storkel[1], Junko Maekawa[1], & Andrew Aschenbrenner[2]

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

2012 International Child Phonology Conference

KU
THE UNIVERSITY OF KANSAS

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, [weɪt] for target word /weɪt/, “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

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

Word Learning Scenario

	Correct Articulation (IN) Target /m/ produced as [m]	Misarticulation (OUT) Target /v/ produced as [v]
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?

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

Last Question

- Does word frequency influence the effect of homonymy?

	Correct Articulation (IN) Target /m/ produced as [m]
No Homonymy	This is a /moʊb/ (novel word) Child says: /moʊb/ (novel word)
Homonymy Low Freq	This is a /mʌd/ (known word 'mud') Child says: /mʌd/ (known word)
Hi Freq	This is a /mɑm/ (known word 'mom') Child says: /mɑm/ (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) Target /n/ produced as [n] Target /p/ produced as [p]	Misarticulation (OUT) Target /θ/ produced as [f] Target /ɹ/ produced as [w]
No Homonymy	/noʊk/, /num/ /pʌd/, /pɪb/	/θʌt/ ([fʌt]), /θɪd/ ([fɪd]) /ɹɑp/ ([wɑp]), /ɹun/ ([wun])
Homonymy (frequency)	'nip' (low), 'knock' (high) 'pad' (low), 'pot' (high)	/θɛd/ ('fed' - low), /θæt/ ('fat' - high) /ɹɛb/ ('web' - low), /ɹɪn/ ('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

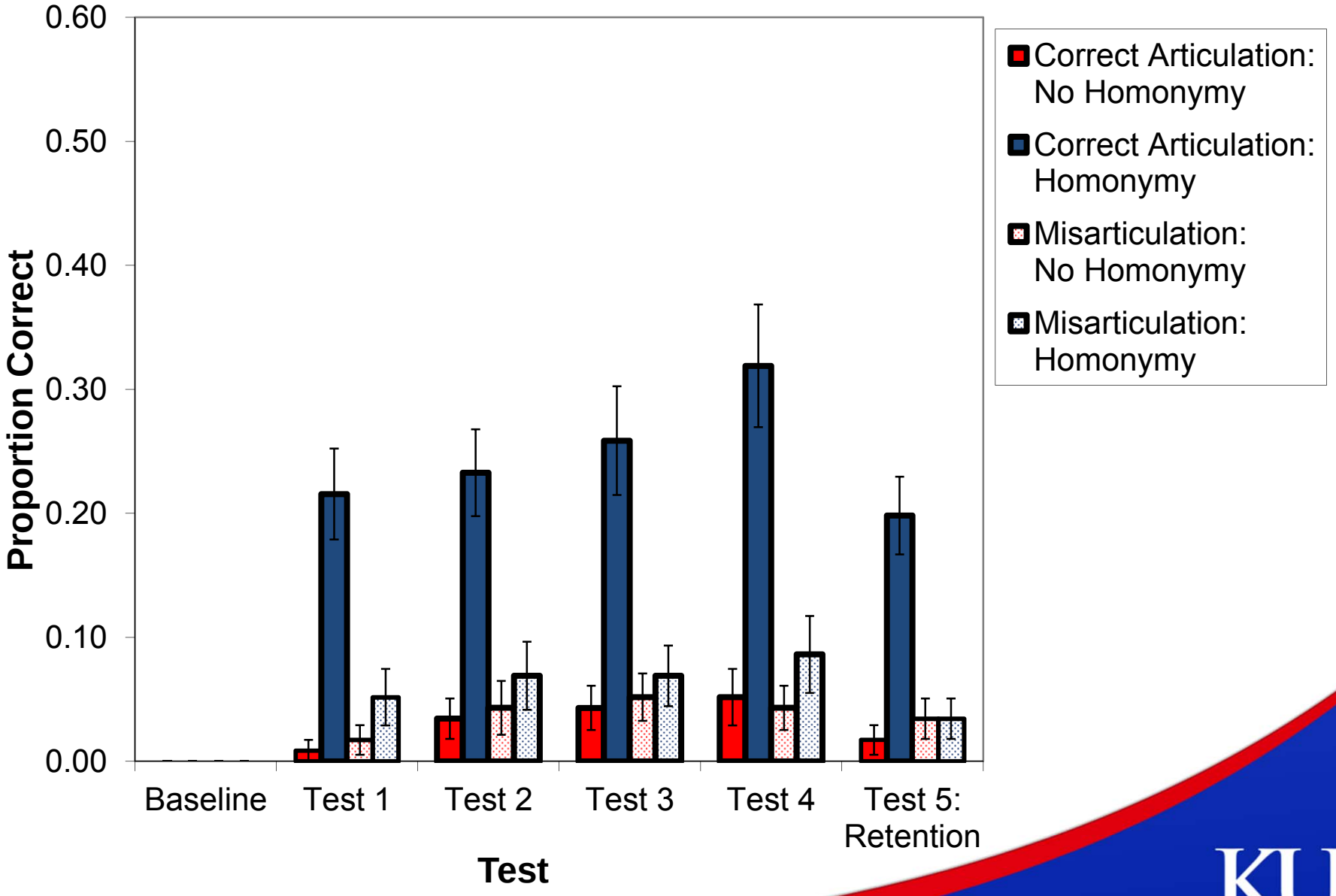
Analysis

- 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

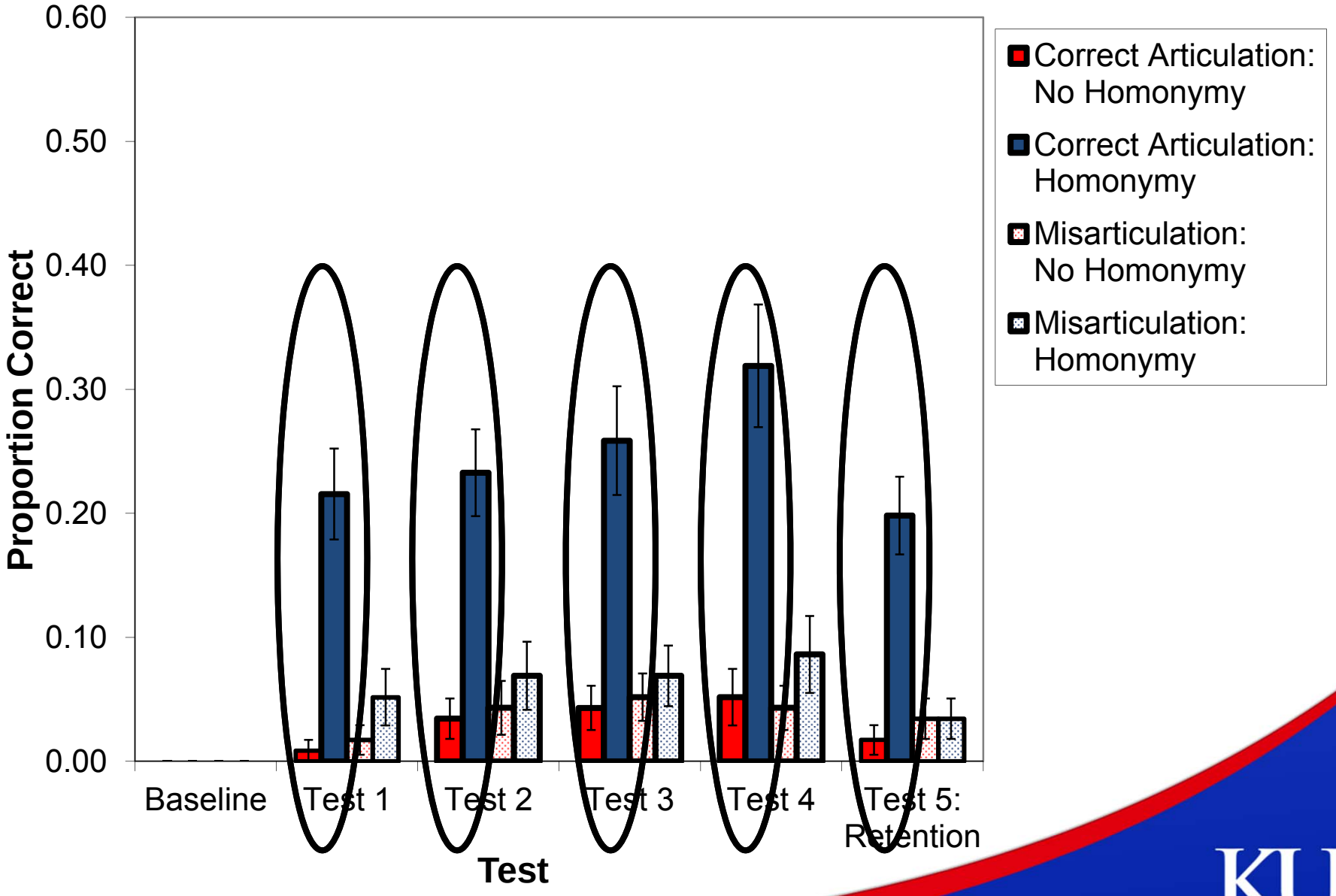
- Significant Random Effects
  - Participants, χ^2 (1) = 49.85, p < .001
  - Items, χ^2 (1) = 304.71, p < .001

- 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



KU THE UNIVERSITY OF KANSAS

Does homonymy facilitate or impede learning of correctly articulated words?

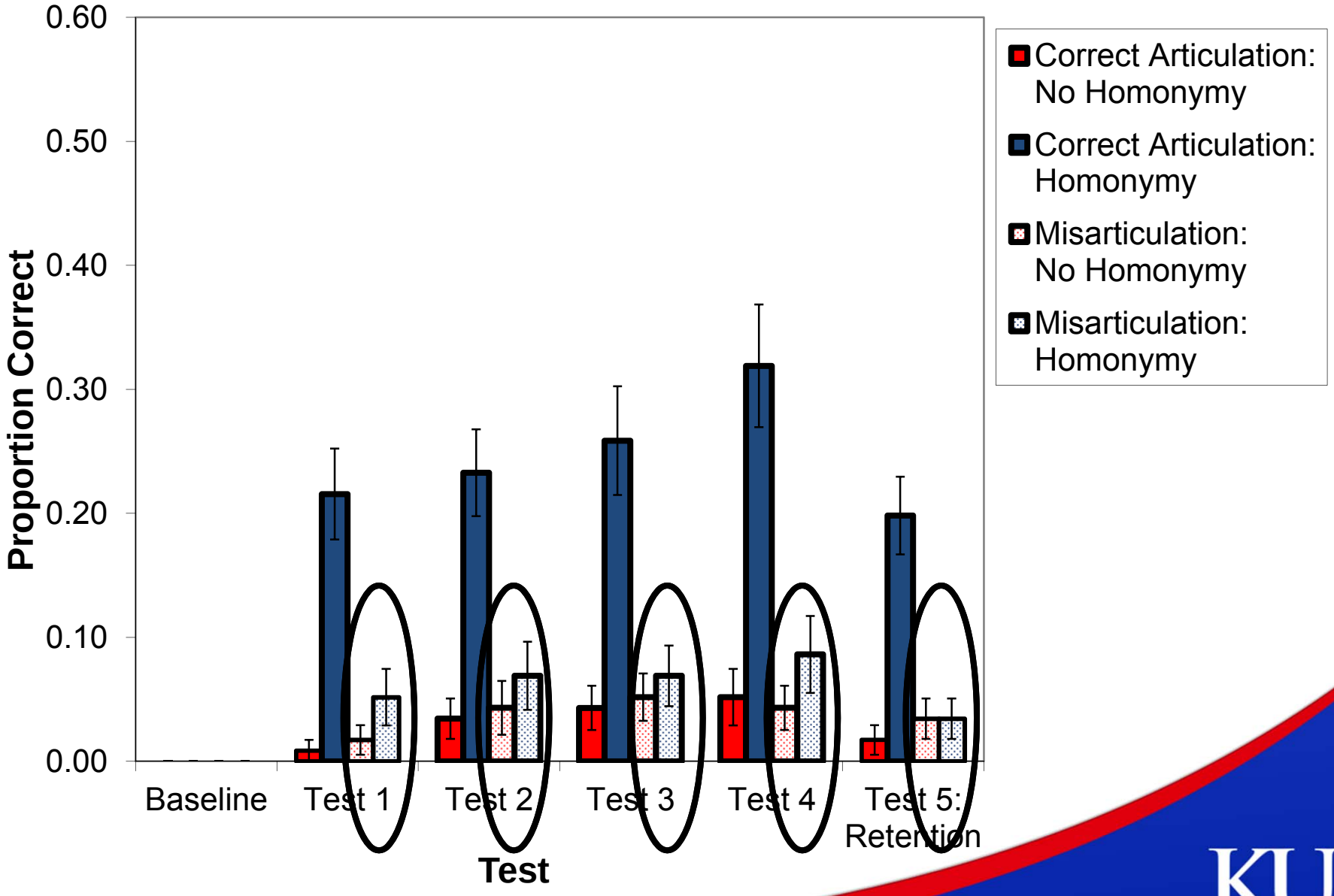


THE UNIVERSITY OF KANSAS

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

Does word frequency influence the effect of homonymy?

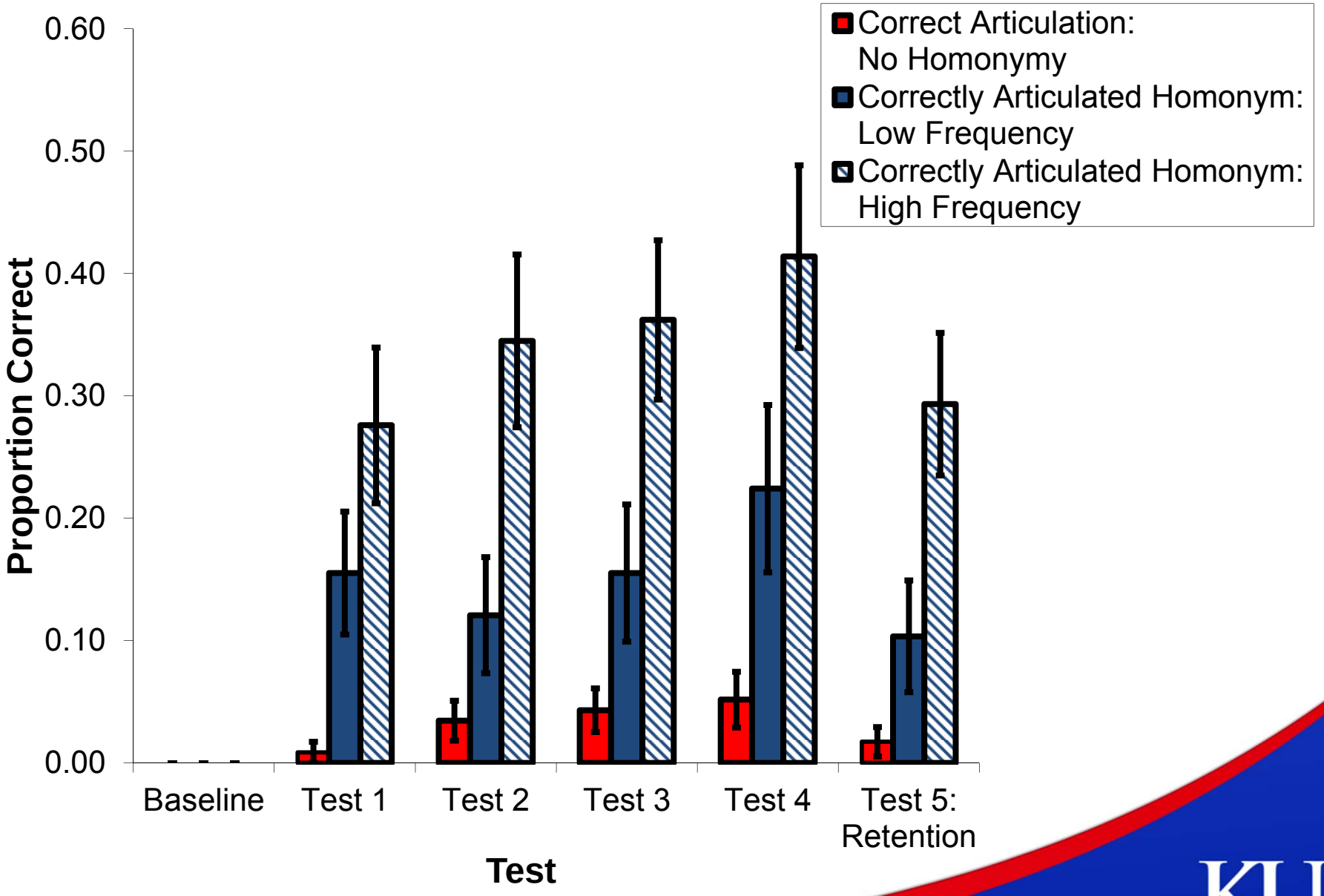
Significant effect of homonymy for correctly articulated words only

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

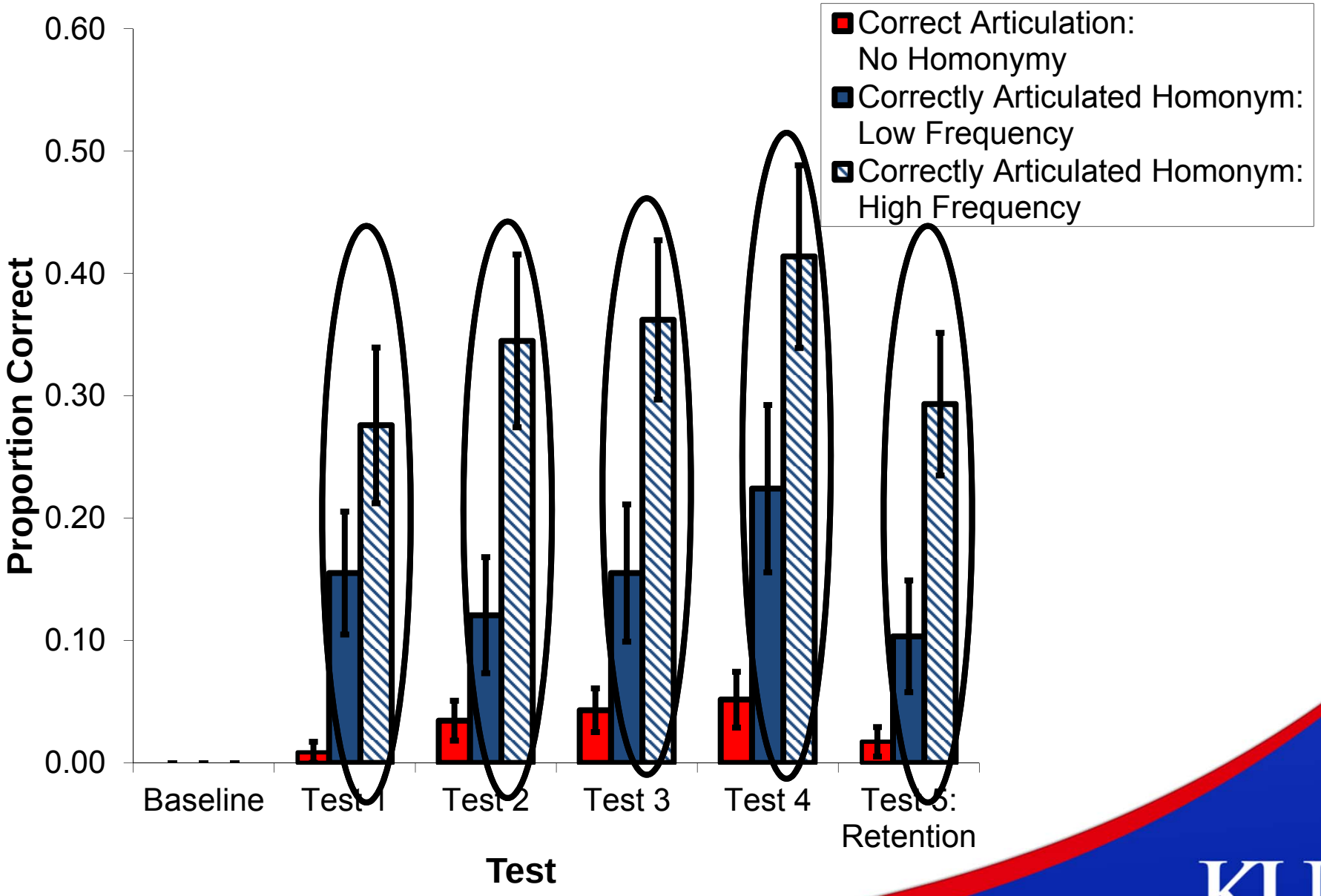
Analysis & Results

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

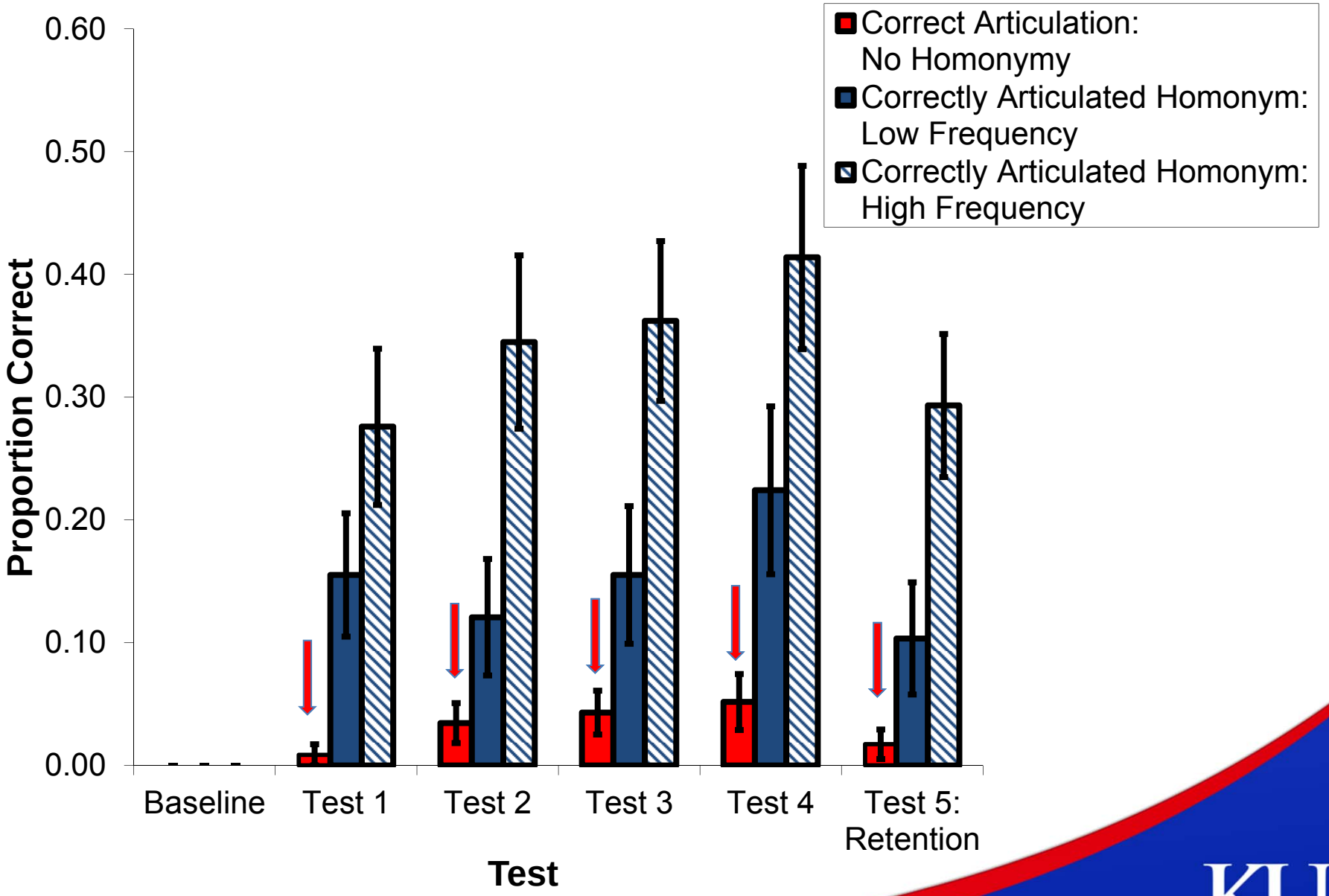
- Significant fixed effects
  - Frequency (low, high), F (1, 520) = 6.56, p = .01



KU THE UNIVERSITY OF KANSAS



THE UNIVERSITY OF KANSAS



KU THE UNIVERSITY OF KANSAS

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) Target /m/ produced as [m]
No Homonymy		This is a /moʊb/ (novel word) Child says: /moʊb/ (novel word) *Learn semantic representation* *Learn lexical representation*
Homonymy	Low Freq	This is a /mʌd/ (known word 'mud') Child says: /mʌd/ (known word) *Learn semantic representation* *Update lexical representation*
	High Freq	This is a /mɑm/ (known word 'mom') Child says: /mɑm/ (known word) *Learn semantic representation*

Thank you!

- Supported by:
  DC 08095, DC 05803,
  and HD02528
- 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

KU
THE UNIVERSITY OF
KANSAS