Phonological Alternation Learning is Facilitated by Relative Frequency Cues

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1. Alternations and Decomposition

MAIN QUESTION: Is there a link between lexical frequency distribution and phonological representations?

Speakers are attuned to differences in **lexical decomposition** and may rely on them to learn idiosyncrasies in morphological productivity [4, 5], phonotactics [6], and phonological alternations [2, 3,12]

Decomposition: Abstract lexical parsing process part of lexical access; predicted using **token relative frequency** [4, 5, 6]

Decomposed parse	vs	Whole-word parse
/move/ + /-ment/	vs	/movement/
Stem freq. > affixed freq.	vs	Affixed freq. > stem freq.

THIS STUDY: Strengthens potential link between decomposition and phonological representations by investigating effects of relative frequency on varied phonological rule application

(1) English Stress Shift: Word prominence shifts rightward when suffixes are added [1, 8]

a. párent + al → [parént-al] b. párent + hood → [párent-hood]

Application suffix ☺ **Non-application suffix ☹**

Previous analyses claim speakers have internalized application and non-application categories which derive correct phonological patterns [1, 8]

What information do learners use to establish these categories?

Hypothesis: Speakers rely on cues to lexical decomposition (e.g. relative frequency) to accurately learn phonological patterns with varied application

3. Procedure

Artificial language learning study (3 phases):

1. **Learning**: Shows examples of how the artificial language works
2. **Verification**: Re-presents learning stimuli and asks participants to verify correct pronunciations
3. **Test**: Asks participants to generalize pattern to novel items

THIS STUDY: Learning phase shows meanings of stems and suffixes, phonological rule application, and artificial frequency distribution [7, 10]

Stem and suffixed forms presented in **particular relative frequency ratio** which encourages or discourages decomposition for a given suffix

Decomposed parse	vs	Whole-word parse
Stem freq. > affixed freq.	vs	Affixed freq. > stem freq.

Figure 1: Experimental Conditions for Both Suffix Types:

	Baseline	Congruent	Incongruent
Non-application suffix	No frequency cue	Decomposed parse	Whole-word parse
Application suffix	No frequency cue	Whole-word parse	Decomposed parse

Decomposed parse strengthens separate stem and suffix representations (e.g. /move/ + /ment/), making the **non-application pattern** *easier* to learn

Whole-word parse promotes combined stem-suffix representation (e.g. /movement/) making the **non-application pattern** *harder* to learn

Prediction: Test phase response accuracy in congruent condition > incongruent condition

2. Participants and Stimuli

Artificial language learning (ALL) study

180 native English-speakers participated in PCIbex [11] experiment, recruited via Prolific [9], excluded 13 → **167 total participants**

Nonsense word stems (CVCVC) and 2 nonce suffixes (VCV)

Stem-final voicing assimilation rule applies with one suffix but not the other

[porap] + [-iso] → [porab-iso] (assimilation applies – application suffix)

[porap] + [-ifa] → [porap-ifa] (no assimilation – non-application suffix)

All stimuli associated with meanings

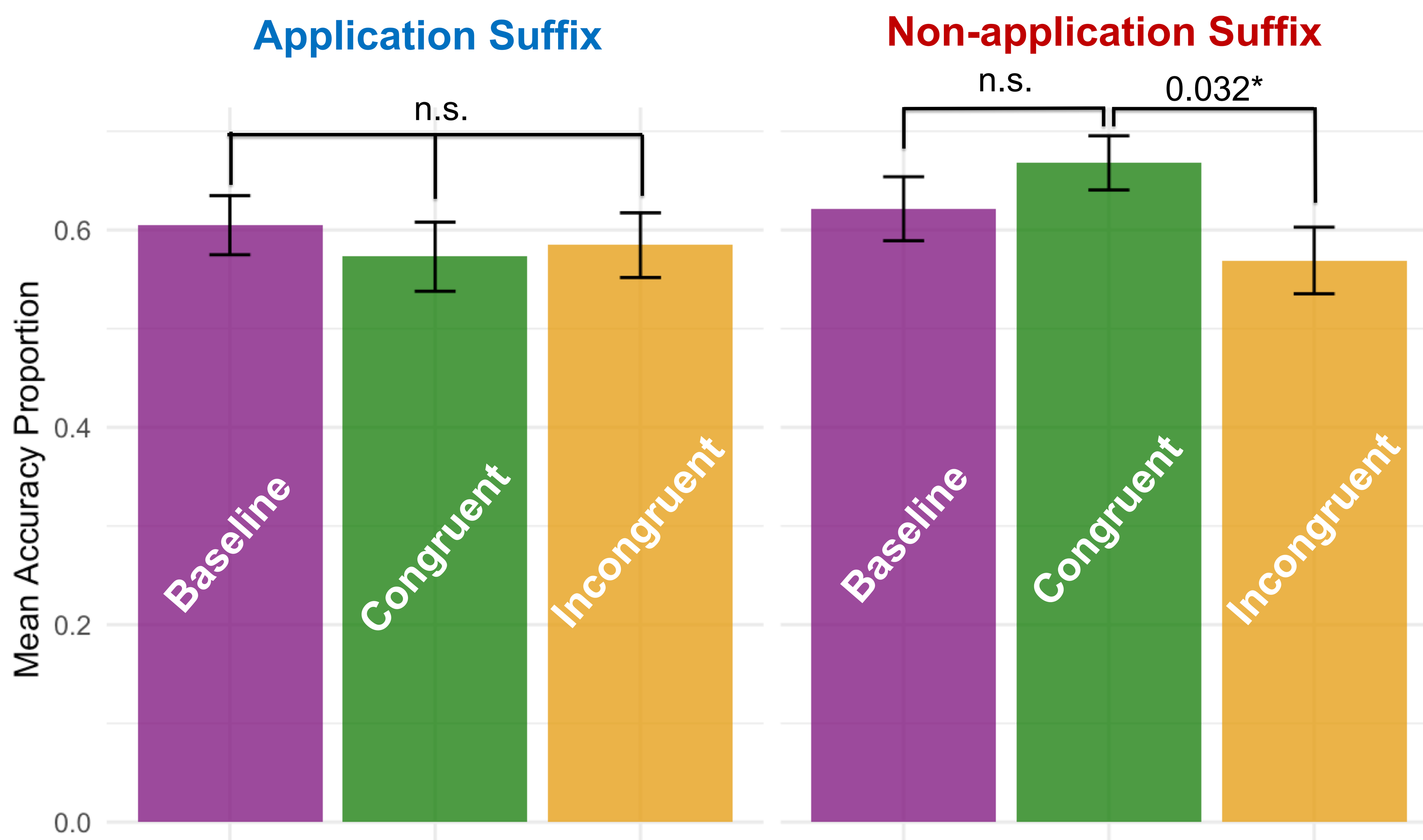
Stem = objects and animals, suffix 1 = 'small', suffix 2 = 'big'

Suffix meanings and application/nonapplication counterbalanced

138 total trials (88 learning, 20 verification, 30 test)

4. Results

Figure 2: Accuracy for Each Suffix Type Between Conditions:



For application-suffixed items, generalized linear mixed effects model found no statistically significant accuracy differences between conditions

For non-application-suffixed items, accuracy was significantly higher in congruent condition than in incongruent condition ($\hat{\beta}$ = -0.50 p = 0.032)

5. Conclusions

STUDY GOAL: Find evidence that decomposition (indicated by relative frequency cues) facilitates learning of application and non-application suffixes in phonology

Results showed that in the **congruent** condition, learning of the non-application pattern was *facilitated* compared to the **incongruent** condition

Suggests that lexical parsing processes like decomposition play an active role in helping speakers learn which forms should/should not undergo phonological alternations

Supports phonological theories which incorporate distributional lexical information into phonological representations

Interestingly, decomposition cues did not show significant learning differences for application pattern across conditions

- Is productivity (type frequency) more relevant here?

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