

The interaction between phonotactic probability and age of acquisition of sounds in nonwords

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Abstract

The development of word representations in the lexicon involves the acquisition and use of additional word-characteristics, such as phonotactic probability and age of acquisition (AoA). The interaction between phonotactic probability and AoA has not been explored extensively in children. Therefore, the purpose of the present study was to explore the interaction of phonotactic probability and AoA of speech sounds on children's judgement of words. Children aged 4-6 heard CVC nonwords consisting of early- and late-acquired sounds. Within each configuration, words had a common or rare phonotactic probability (Storkel & Hoover, 2010), and were controlled for duration. Children were asked to indicate whether the word is an item "for kids" or "for grownups" in a self-paced 2 alternative forced-choice task. Early results revealed that children's judgment of words may be influenced by phonotactic probability, but this influence is dependent upon the CVC condition.

Introduction

- Phonotactic probability affects adults' behavioral responses to words and alters listeners' semantic interpretation of words (Vitevitch & Donoso, 2012).
 - Adults were more likely to buy labels/brands with high phonotactic probability than low (AoA held consistent)
- Children's word learning is influenced by phonotactic probability (Edwards, Beckman, & Munson, 2004; Storkel et al., 2010)
- Manipulating AoA of sounds in words has been explored in the context of marketing with adult listeners.
 - Words with early-acquired sounds were judged to be "basic" items
 - Words with late-acquired sounds were "luxury" items (Pathak, Calvert, & Velasco, 2017).
 - Differences in word makeup**
 - Duration differences**
 - No control for phonotactic probability**
- AoA has not been explored extensively in children with regard to lexical acquisition
- Examining the interaction between phonotactic probability and AoA may lead to a better understanding of higher-level decision making that occurs in children

Objective

- Expand upon previous work to explore the interaction between age of acquisition and phonotactic probability in children's word judgments



Figure 1. Visual Display (Adults)



Figure 2. Visual Display (Children)

Methods and Materials

- 18 monolingual preschool children, with normal hearing, age 4-6 participated in the study.
- CVC stimuli were developed using normative data, and controlled for duration across conditions.
- High [$M=0.051$] and low [$M=0.011$] biphone sum CVC words were selected from a nonword database (Storkel & Hoover, 2010)
- Preliminary testing included the Goldman-Fristoe Test of Articulation-3, and the Peabody Picture Vocabulary Test—4th edition.
- Using MouseTracker (J. B. Freeman & Ambady, 2010; J. Freeman, Dale, & Farmer, 2011), over external speakers, children were instructed to listen to some new words that represent items
- Children completed 5 practice trials of real words with feedback, then completed 48 self-paced experimental trials without feedback.

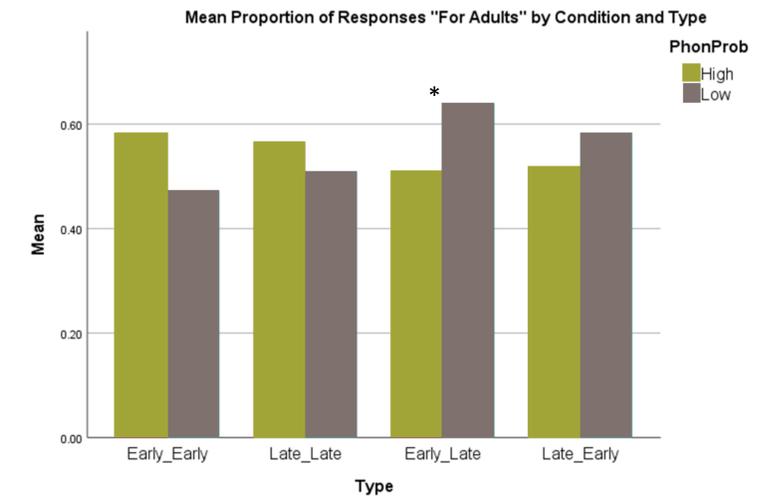
Results

Data were extracted using MouseTracker Analyzer. Proportion of "for adults" responses was calculated using the responses measured through the software. A 2 Phonotactic Probability by 4 CVC Typicality repeated measures ANOVA was conducted. Planned post hoc testing included paired samples t-tests with Bonferonni correction for multiple comparisons.

- A significant interaction between Phonotactic Probability and CVC Typicality was found: [$F(1,17)=6.675, p=0.019, \eta_p^2=0.282$]
- No main effect of:
 - Phonotactic Probability [$F(1,17)=0.041, p=0.842, \eta_p^2=0.002$]
 - CVC Typicality [$F(1,17)=0.1059, p=0.318, \eta_p^2=0.059$]
- In Early-Late Condition, paired samples t-test ($p<0.0125$) showed a significant difference [$t(17)=-2.958, p=0.009$]
- Other CVC type pairs were not significantly different based on Phonotactic Probability

Table 1. Nonword stimuli

| | High | Low |
|-------------|--|---|
| Early-Early | /bib/ /nem/ /wæp/ /wɒd/ /jæd/ /pɛb/ | /mɒb/ /nɒp/ /jɔm/ /noʊd /həʊb/ /jɔɪp/ |
| Late-Late | /læz/ /ɪs/ /θaɪ/ /loʊs/ /ʃɒs/ /ʃɪl/ | /ðɒʃ/ /lɒz/ /ʃouθ/ /ɪʃ/ /θaʊs/ /zɒʃ/ |
| Early-Late | /bɑθ/ /dɛʃ/ /his/ /nɔɪ/ /pɒz/ /waɪs/ | /dɒʃ/ /hɒɪz/ /nɛz/ /wɒθ/ /jɒθ/ /jɒʃ/ |
| Late-Early | /ðæd/ /lɒd/ /ʃun/ /zɪm/ /ðɪn/ /lɒm/ | /ðɪb/ /lɒb/ /θum/ /θaʊd/ /zoup/ /zɪm/ |



Discussion

- It was predicted that the most robust effects of AoA would occur in conditions where AoA was consistent, and that all low PP would yield higher rates of "for adults" responses
- If C1 and C2 were the same AoA, children selected "for adults" more in high PP conditions than in low PP conditions.
- If C1 and C2 were different AoA, children selected "for adults" more in low PP conditions than in high PP conditions.
- Vitevitch & Donoso (2012) found that items with high phonotactic probability names are more likely to be purchased—this correlated to word goodness ratings
 - Our results align with this finding in conditions where C1 and C2 varied
- When AoA is Early_Late, children chose "for adults" more in low phonotactic probability conditions; the position of the sounds in words may influence responses.

Conclusions

Children are sensitive to word-characteristics such as phonotactic probability and age of acquisition of sounds within the words when making judgments about novel words.

Limitations

- More participants to strengthen the statistical power
- Krueger & Storkel (Under Review) found that children's responses in a forced choice task can be influenced based on the stimuli and responses.
- Other factors may be involved, e.g. length of word, syllable shape, position of sounds in words

Future directions

- Pilot additional words to examine positional differences
- Introduce foil conditions

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