

Generalization of vowel-shift adaptation in children after exposure to foreign-accented speech

Margarethe McDonald¹, Amélie Bernard², Katherine White³, and Chris Fennell⁴

¹University of Kansas (USA), ²Social Research and Demonstration Corporation (Canada), ³University of Waterloo (Canada), ⁴University of Ottawa (Canada)

Adaptation to foreign-accented speech in adults can happen within just a few minutes of exposure [2]. Children struggle more with processing foreign-accented speech than adults, not reaching adult-like processing until well into adolescence [1]. It has been suggested that both adults and children can use phoneme-specific strategies for accent adaptation; for example, lexically-guided retuning (e.g., [4]). On the other hand, a more phoneme-nonspecific general expansion strategy has also been suggested (e.g., [3]). Findings vary as to how specifically or generally toddlers apply strategies for speech adaptation. 20-months-old toddlers have demonstrated lexically-guided retuning [6], but 2-year-olds have demonstrated general expansion (e.g., [5]). The specific strategies used beyond toddlerhood is not clear. The current study aimed to examine if 3-5-year-old children generalize vowel-shifts adaptation to new vowels and new speakers. We expected that children would apply phoneme-specific adaptation by accepting typical, but not atypical vowel shifts, when listening to a Spanish-accented English speaker. Further, we expected that prior exposure to Spanish-accented speech would lead to stronger phoneme-specific adaptation.

Sixty-four monolingual North-American English-speaking children between ages 3 and 5 years ($M = 4.34$, $SD = .83$) participated in the ongoing study, which aims to collect data from 80 children. Children were assigned to one of two (between-subjects) exposure conditions: in one condition, children heard a Spanish-accented speaker read an illustrated story which contained vowels shifted in a direction typical for Spanish-accented English (e.g., /ɪ/ produced as /i/ and /ɛ/ produced as /eɪ/). In the other condition, children heard a different, native-English speaker read the same story without the vowel shifts. After exposure, children saw pairs of real and novel objects and were tested with words not heard in exposure. These words were pronounced (within subjects) with vowels shifted in the typical direction of Spanish-accented English (e.g., “peeg” /pig/ for “pig” /pɪg/) or the reverse direction, creating an atypical vowel shift (e.g., “kiz” /kɪz/ for “keys” /kiz/). At test, children heard both the same speaker from the exposure phase (native- or Spanish-accented) and the other speaker in counterbalanced order. This resulted in 4 conditions: native-English story/native-English test; native-English story/Spanish-accented test; Spanish-accented story/native-English test; and Spanish-accented story/Spanish-accented test.

Preliminary results using logistic mixed effects models indicated that overall, the effect of test speaker was significant, such that children were more likely to accept a vowel-shifted word as a real word when produced by the Spanish-accented speaker than when produced by the native speaker ($\chi^2 = 4.5$, $p = .04$). Furthermore, children accepted the typical shift significantly more than the atypical shift ($\chi^2 = 6.2$, $p = .02$). There were no significant interactions. Therefore, children were not more likely to accept a typical over an atypical shift for just the Spanish-accented test speaker or after exposure to the Spanish-accented story which contained typical shifts. See Figure 1 for a visualization. Secondary analyses indicated that the effect of vowel shift may be due to item-specific effects. Without the problematic item, the effect of vowel shift was no longer significant, but all other effects remained the same.

These preliminary results indicate that rather than adapting to vowel-specific shifts, children in our study are utilizing a general expansion strategy. Although children were more likely to accept words with shifted vowels as real words when listening to the Spanish-accented speaker, they did not utilize prior exposure to focus their adaptation to just the vowel shift typical of each speaker. These results extend findings of general expansion in 2-year-olds [5] to older children. This indicates that children may not be adapting to the specific phonemic shifts of exposed speech and this may be a contributing factor to difficulty children have with accented speech processing.

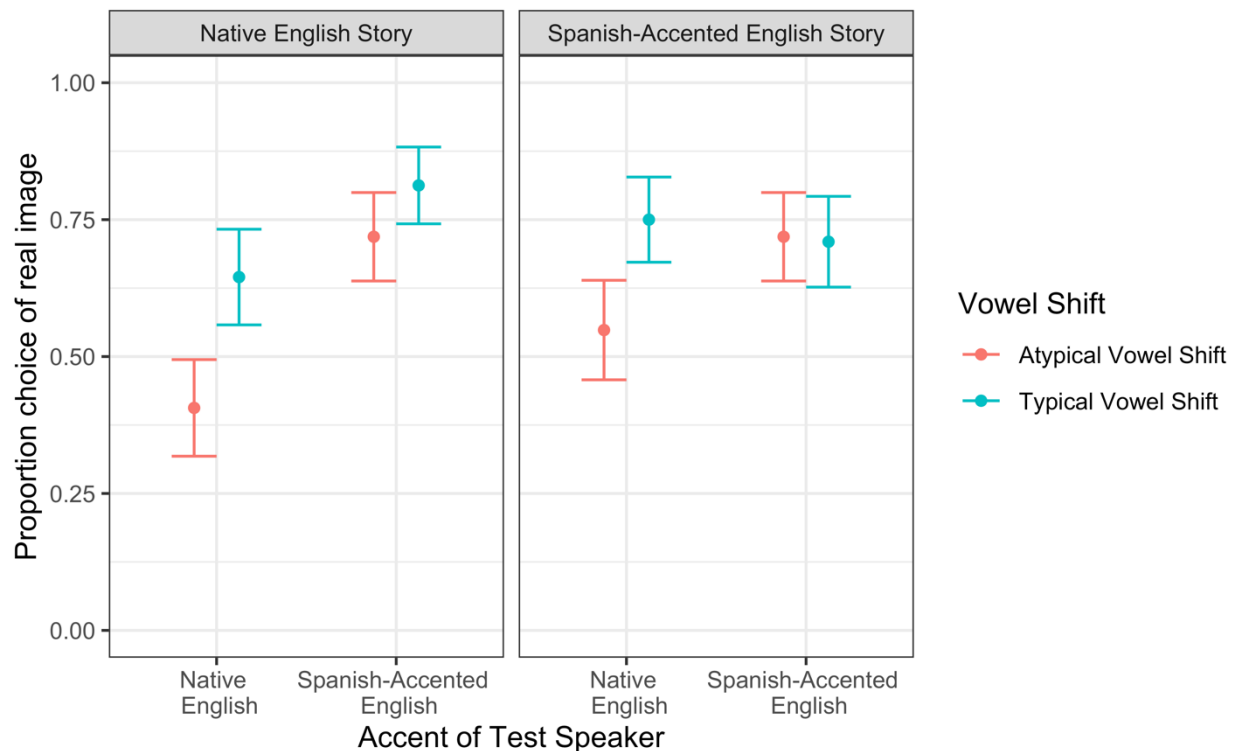


Fig. 1. Children’s image selection as a function of vowel shift (typical or atypical), test speaker accent (native English, Spanish-accented English), and prior story exposure (native English, Spanish-accented English). Proportion choice of real image indicates how frequently children pointed to the real image, rather than a novel image when hearing a word (i.e., choosing an image of a pig rather than a green monster when hearing ‘peeg’).

References

- [1] Bent, T. (2018). Development of unfamiliar accent comprehension continues through adolescence. *Journal of child language*, 45(6), 1400-1411.
- [2] Clarke, C. M., & Garrett, M. F. (2004). Rapid adaptation to foreign-accented English. *The Journal of the Acoustical Society of America*, 116(6), 3647-3658.
- [3] Llanos F. & Francis, A. (2017). The effects of language experience and speech context on the phonetic accommodation of English-accented Spanish voicing. *Language and Speech*, 60(1), 3-26.
- [4] Reinisch, E., & Holt, L. L. (2014). Lexically guided phonetic retuning of foreign-accented speech and its generalization. *Journal of Experimental Psychology: Human Perception and Performance*, 40(2), 539.
- [5] Schmale, R., Seidl, A., & Cristia, A. (2015). Mechanisms underlying accent accommodation in early word learning: Evidence for general expansion. *Developmental science*, 18(4), 664-670.
- [6] White, K. S., & Aslin, R. N. (2011). Adaptation to novel accents by toddlers. *Developmental Science*, 14(2), 372-384.