Perceptual Adaptation in Spanish: Implications for Vowel-specific Factors in the Learning of Novel Accents

Despite the unpredictable and widely variable nature of speech, listeners are still able to encode and parse it into understandable input. This is especially impressive when imagining the processing needed to adjust to novel phonetic variation. Previous research has investigated the different factors that affect a listener's ability to adapt and learn phonetic patterns, including vocal tract differences (Johnson, 1990; Barreda, 2020), accentedness (Maye et al., 2008; Munro & Derwing, 1995; Witteman et al., 2013; Weatherholtz, 2015), and speaker-specific speech patterns (Clapp et al., 2023ab; Luthra, 2023). More specifically, there have been studies investigating the adaptation to novel vowel chain shifts in English listeners. For example, Weatherholtz (2015) and Maye et al. (2008) both reported that listeners are able to learn a novel vowel chain shift and apply learned patterns to new words and speakers, mediated by exposure and direction of vowel shift. However, this research has primarily been focused on English listeners.

The current study investigates the perceptual learning of a vowel chain shift in Spanish listeners through a lexical decision task following an exposure phase. By investigating the learning pattern of Spanish speakers, this study contributes to current understandings of acquisition of novel phonetic variation with a non-English vowel inventory and listeners with little experience in vowel shifts. English listeners are exposed to a variety of different accents and dialects where vowels merge, or participate in chain shifts. Thus, many English listeners have learned to map a variety of vowel realizations to their respective categories. In contrast, Spanish listeners are not exposed to such categorical vowel shifts, meaning they have no previous foundation that would lead them to perceptually accommodate to vowel shifts. Another motivation for studying Spanish listeners is the difference in vowel inventories between English and Spanish. Spanish has a much smaller vowel inventory compared to English, and is also made up of solely peripheral vowels. Differences in the crowding and habitual overlap between vowels in the two languages expose listeners to potentially overlapping phonetic realizations.

109 Spanish L1 speakers in Mexico were recruited through Prolific (https://prolific.com/) [Date accessed: August 20, 2024] and participated in a lexical decision task following an exposure phase through Gorilla (Anwyl-Irvine et al., 2020). In the exposure phase, participants heard one of three portions (2, 5, or 10 minutes long) of the story of Pinnochio with either shifted or unshifted vowel pronunciations. Thus, there were six groups of participants crossing three story durations (2, 5, 10 minutes) with shifted or unshifted vowels. The shifted condition involves a counter-clockwise vowel chain shift: /i/ → [e], /e/ → [a], /a/ → [ɐ], /o/ → [u], and /u/ → [ʉ]. Listeners then participated in a lexical decision test phase. In each test trial, the listener heard an audio file and was asked to categorize it as a word or a nonword. The test phase contained critical items (i.e. words containing a shifted vowel), control words (i.e. words without any shifted vowel), and control nonwords (i.e. phonologically-licit nonwords).

Endorsement rate (rate of word responses) was collected. A Bayesian Bernoulli mixed-effects model with mildly informative priors and a random intercept for participant was fitted to the data to assess the effects of exposure condition (shifted and unshifted), exposure time (2, 5, and 10 minutes), word condition (critical, control word, and control nonword), and vowel on endorsement rates. Figure 1 shows the model prediction of endorsement rates by word condition, exposure time, and exposure condition. For critical items, the model predicts significant increases in endorsement rates after exposure to the shifted condition as opposed to the unshifted condition, and a smaller, yet significant increase in endorsement rates as exposure time increases. Figure 2 shows the model predictions for critical items separated by vowels and exposure condition. For critical items, it predicts that all vowel endorsement rates, except for /e/, are improved with exposure. Vowel endorsement rates are predicted to vary by vowel: from lowest to highest /e/, /i/, /o/, /a/, and /u/.

The results of this study reveal two main findings: smaller effects of exposure on learning than previously reported, and the presence of vowel-biased endorsement rates. The difference from previous literature, which has reported higher effects of exposure implies some form of language-specificity in perceptual learning that has not previously been attested. Because of differences in the vowel inventory, Spanish listeners may behave differently from English listeners. On the other hand, this could be due to the lack of exposure to vowel shifts in the wider Hispanic language community. Vowel boundaries are not as flexible as those for languages who experience more categorical variation of vowels. These two explanations suggest that perceptual learning is mediated by experience and phoneme inventories, not an inherent skill in a listener's perceptual processes. Future directions of this research will disentangle language-specific and experiential effects on perceptual learning by exploring the phenomenon across typologically diverse languages. For instance, Swedish, which contains a crowded vowel inventory, however, does not have dialectal vowel chain shifts. The talk will conclude with additional theoretical implications for language-specific perceptual learning outcomes.

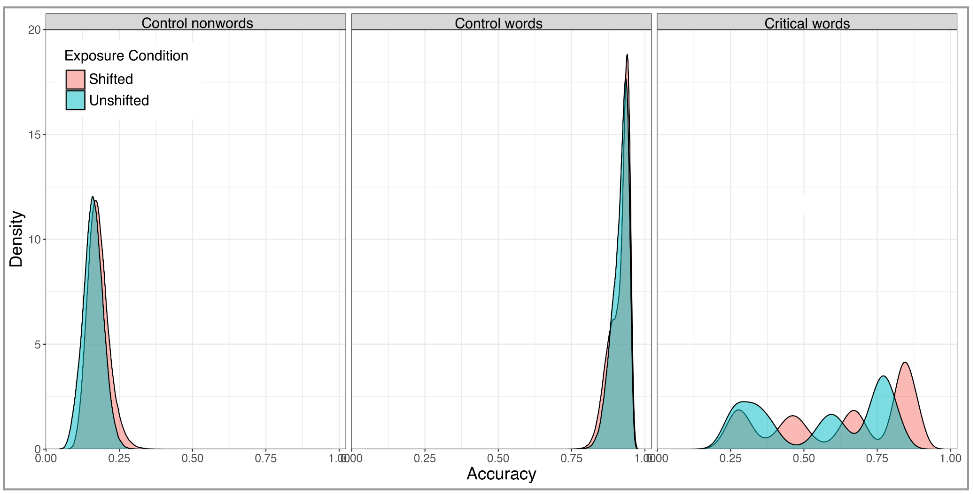

Figure 1: Bayesian model predicted endorsement rates separated by word condition (facets), and exposure condition (color).

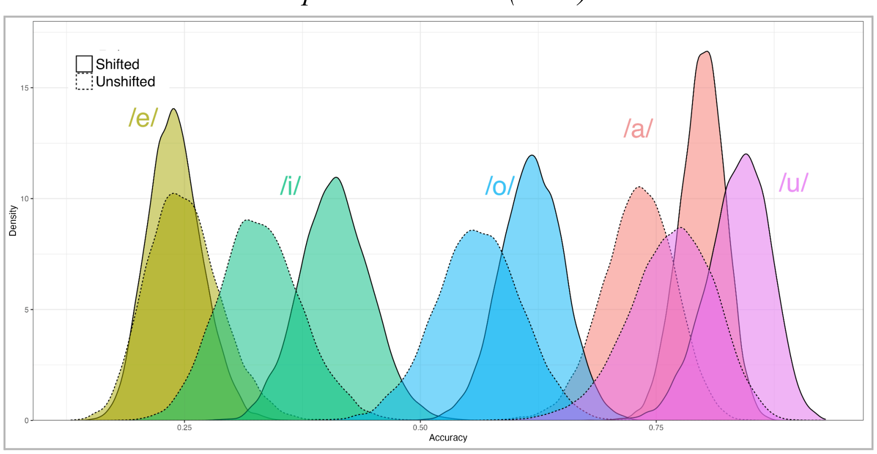

Figure 2: Bayesian Model prediction of endorsement rates for critical words separated by vowel (color) and exposure condition (outline).

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