The role of native-language phonotactics in the discrimination of non-native contrastive phonemes

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BACKGROUND

- Second-language (L2) learners have difficulty perceiving L2 phonemic contrasts that do not exist in the native language (L1), especially when the L2 contrastive pair is allophonic in their L1 (Strange, 2011).
- We tested Spanish-English bilinguals' ability to discriminate two types of contrastive consonantal pairs in English:
  1. /d/-/ð/, which is allophonic in Spanish
  2. /b/-/v/, which is similar to an allophonic pair in Spanish (/b/-/β/), but /v/ does not exist in Spanish
- The Speech Learning Model (Flege, 1995) proposes that dissimilar L2 sounds may lead to the formation of new phonological categories while similar sounds map onto existing L1 categories.
- Based on the Speech Learning Model, we predicted that native Spanish speakers would have more difficulty with /d/-/ð/, which would map onto an allophonic L1 pair compared to /b/-/v/, which would be considered more distinct due to the novelty of the /v/ phoneme.
- We also predicted that the way the corresponding allophonic pairs in Spanish are realized may influence listeners’ ability to discriminate the two sounds.
- In Spanish, the allophonic pairs /d/-/ð/ and /b/-/β/ follow these phonotactic constraints:
  1. Realized as stops (/d/, /b/) in word-initial position
  2. Realized as fricatives (/ð/, /β/) in post-vocalic position

Do native-language phonotactics influence the degree to which L2 listeners are able to discriminate non-native contrastive phonemes?

METHODS

Participants
- 20 native Spanish speakers aged 21-45 years (mean = 31)
- Began learning English between ages 7-32 years
- English proficiency: Low Intermediate to Advanced

Stimuli
- 36 CVCVC pseudo-word minimal pairs with English phonotactic rules
- Two different pseudo-word pairs for each of three positions:
  - Word-initial (bessit-vessit)
  - Word-medial (sabick-sick)
  - Word-final (lette-lette)

Task
- AXB paradigm: Three pseudo-words played in succession. Participants must match the target (middle) pseudo-word with either the first (A) or third (B) pseudo-word.

Analysis
- Accuracy analyzed using a series of generalized linear mixed models with binomial errors and a logit link.
- Random intercepts by participant and by word set. Models with random slopes generally would not converge.
- Performance on four trials at each crossing of contrast type, contrast position, experimental condition, word set, and participant were aggregated and treated as unit of analysis. Analyses for each contrast type conducted separately.

RESULTS

- A mixed-effects logistic regression revealed a significant three-way interaction between condition, position and contrast (p < .001).
- For /b/-/v/ contrast words, there was a significant difference between control and experimental trials in the medial position (p < .001), but not the initial or final positions.
- For /d/-/ð/ contrast words, there was a significant difference between control and experimental trials in the medial position (p = .004), but not the initial or final positions.

DISCUSSION

- In contrast to the predictions based on the Speech Learning Model, the patterns were the same for both contrastive pairs.
- Contrasts in word-medial position were the most difficult for Spanish speakers to discriminate.
- Salience argument: Initial and final positions are more salient (primacy and recency effects) and hence acoustic-phonetic information is easier to remember and compare across items.
- Variability argument: Expectations about inter-token variability may differ by position. Word-initial position may only allow the stop allophone (/d/-/β/) whereas for word-medial position, the fricative allophone is expected, but the stop allophone may be considered equally acceptable. Word-final position may be restricted to the fricative.
- A follow-up study will investigate the variability in the production of these allophones by Spanish speakers in Spanish and their degree of acceptability for different variants at each word position.

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