Lexical Frequency Effects on Place of Articulation of Voiced Coronal Stops of Spanish-English Bilinguals

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The present study investigates lexical effects on the production of /d/ in the speech of Spanish-English bilingual speakers. The production of coronal stops by Spanish monolinguals has been shown to differ in place of articulation (POA) from the production of the corresponding phones by English monolinguals. Spanish, like other Romance Languages (e.g. Portuguese, French, Italian, and Catalan), has dental /t̪ d̪/ (Hualde, 2005), whereas English has alveolar /t d/ (Hammond, 1999). In this study, I examine the acoustic properties of voiced coronal stops, as produced by L1-Spanish, L2-English bilinguals, in order to investigate POA changes as a result of the perception of acoustic differences of /d ~ d̪/ in highly-frequent words.

Conflicting results have been reported in regard to L2 speakers' perception of non-native sounds. For instance, Lively et al. (1994) show that late L2 speakers can be trained to perceive non-native sounds, whereas Pallier et al. (1997) indicate that early (4-5yo) sequential Spanish-Catalan bilinguals failed to learn the Catalan /e ~ ɛ/ distinction, compared to simultaneous bilinguals. One possible account for these conflicting findings may be lexical frequency, as high word frequency has been reported to facilitate phoneme perception in word recognition (Pisoni et al. 1985) as well as production accuracy in first and second language acquisition (Leonard & Ritterman, 1971; Baker & Trofimovich, 2008). Another contributing factor could be cognate status of words; for example, Spanish-English bilinguals have been reported as producing English-like VOT values in their Spanish speech for words that have an English cognate (Amengual, 2012).

Although phoneme perception and categorization in an L2 have been vastly explored, to date, production effects on POA in bilinguals with knowledge of languages with contrasting POA of coronal stops have not been tested. Accordingly, this research investigates POA differences in Spanish and English based on word frequency and cognate status in English-derived technology jargon and non-jargon lexical items by IT professionals. Taking into account frequency facilitation effects and lexical diffusion phenomena (Bybee, 2002), I hypothesize that, if English L2 speakers develop an alveolar POA category, highly-frequent words will be the first to be produced using this newly acquired category.

This study examines the production of the voiced /d/ in 11 Spanish-English bilinguals working in the technology industry in Mexico, who have Spanish as their L1 and English as L2. Participants read aloud a list of 93 /d/-initial words that were controlled for language (Spanish, English), word frequency (high, low), and generality (IT jargon, non-jargon). Cognate status (cognate, non-cognate) was also included to test for cognate interference effects (Gollan & Acenas, 2004; Amengual, 2012). In addition, subjects also participated in a sociolinguistic interview (cf. Labov, 2001) and completed a demographic questionnaire.

The production data were transcribed as textgrid files and analyzed in Praat with respect to five acoustic metrics that have been reported as indicative of POA, namely relative burst intensity, center of gravity (COG), standard deviation (SD), skewness, and kurtosis (e.g. Jongman et al., 1985; Sundara, 2005; Sundara, M. & Polka, 2008; Casillas et al., 2015). While the English data were aligned using the Berkeley Phonetics Machine forced aligner—an implementation of the Penn Forced Aligner (Yuan & Liberman, 2008)—Spanish data were aligned with faseAlign

(Wilbanks, 2018). Pandas DataFrames were created with the values for all metrics, and each was treated as a dependent variable for mixed-effects linear regression models in R.

The results indicate a POA distinction as a function of language in the four spectral measurements (i.e. COG, SD, skewness, and kurtosis, $p<0.001$). Relative intensity analyses also returned an interaction between language and jargon type, revealing that English-jargon words are more alveolar-like ($p<0.05$) than non-jargon words. These results suggest that jargon words (i.e. high-exposure words) lead the way in creating a new phonetic category for coronal stops in the L2 of these bilinguals. I argue that these findings shed light on our understanding of phonetic categorization, namely that acoustic perception in high frequency phonemes can lead to POA changes in the production of L2 sounds. The results from the present study suggest that bilinguals have two articulations: [d] and [d̪], and that high lexical exposure (e.g. community jargon) can better predict linguistic phenomena such as sound changes, more so than general frequency.

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