

Influences on perceived foreign accentedness: Acoustic distances and lexical neighborhoods

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We often encounter speakers with non-native accents who produce speech different from typical native productions [1]. Native listeners are sensitive to these deviations and the degree of deviation along acoustic variables has been shown to affect how native listeners assign accentedness ratings to non-native speech [7]. Additionally, lexical variables may influence the perception of foreign accentedness [5]. This study proposes a usage-based model of the perception of foreign accentedness which incorporates both acoustic and lexical variables. Specifically, the model includes measures of acoustic properties relative to typical native productions and measures of phonological connectivity among words.

Forty monosyllabic English words, each recorded from nine native speakers of Chinese, were extracted from the Wildcat corpus [8]. Acoustic measurements (word duration, vowel duration, and formant values) were then compared with typical native speaker values (also from the corpus) to create distance measures. Lexical frequencies were collected from COCA [4] and phonological neighbors were extracted from the English Lexicon Project [2]. Neighbors are defined as words with a one-phoneme difference (e.g. /bæt/ is neighbors with /sæt/ and /mæt/) and graph theory was used to quantify the connectivity (i.e., clustering coefficient) among them (cf. [3]). Accentedness ratings were collected from 30 native English-speaking participants on the 40 stimuli spoken by each of the nine non-native speakers and one native speaker. Item means were calculated and modeled as a function of the acoustic distances and lexical variables using a generalized additive mixed-effects model [9].

The statistical model reveals that both acoustic and lexical variables influence accentedness ratings with three significant interactions emerging from the data. First, the interaction of the first and second formant distances is correlated with higher ratings. Second, neighborhood density interacts with phonotactic probability such that rating decreases when phonotactic probability is high and many neighbors exist. Denser neighborhoods may provide more targets to which the token could possibly match. Finally, a three-way interaction emerged between vowel-to-word ratio distance (i.e., the distance of the proportion of vowel and word durations), frequency, and clustering coefficient. Thus, increased distance results in higher ratings for low frequency words when there is moderate connectivity among neighbors. This can be interpreted as a local competition effect within a neighborhood.

These results indicate that in the perception of foreign accent there is an interaction between the acoustic properties of the token and the lexical properties of the word. The acoustic results suggest that listeners use multidimensional distributional information from their native language to perceive the foreign accentedness of non-native productions (cf. [6]). The lexical results suggest that the structure of the neighborhood influences how listeners perceive non-native productions. Thus, this interaction points to a lexicon which is both structured and contains probabilistic distributional information about possible instantiations across accents.

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