

ACOUSTIC INDICATORS OF SPANISH-ACCENTED ENGLISH

Amee P. Shah

School of Communication Sciences and Disorders, McGill University
1266 Pine Avenue West, Montreal, Quebec H3G 1A8.

Email: amee.shah@mail.mcgill.ca

1. BACKGROUND

The speech of non-native speakers of a language or “foreign-accented” speech is usually characterized by presence of acoustic deviations from the norm that may pose a challenge to the listeners’ perception. Depending on the degree of speech deviation (among other factors), the listeners’ perception may be affected to varying degrees, ranging from a mild awareness that the speaker is “foreign-sounding” or “foreign-accented”, to a complete breakdown in overall communication due to the reduced intelligibility of the speech.

The present study attempted to address the distinct speech characteristics of Spanish-accented speakers and their influence on the native listeners’ perception of accentedness. Previous research (MacDonald, 1989; Ortega-Llebaria, 1997) involved contrastive phonological analyses of speech characteristics in an attempt to identify the speech deviations that were related to perceived accentedness. Only a few studies have employed acoustic measures in studying Spanish-accented English (e.g. Magen, 1998; Backman, 1978; Flege and Eefting, 1987; Flege, Munro and Skelton, 1992). The above phonological and acoustic studies led to the hypotheses motivating the present study, in that Spanish-accented speech is characterized by deviations in temporal patterns, and that these deviations account, at least in part, for the perception of “foreign-accentedness”.

Two studies were designed to test the hypotheses. Study 1, a perception study, was used to obtain accentedness ratings from native listeners as they listened to multisyllabic words (and sentences) produced by native as well as the non-native (Spanish-accented) speakers. Study 2, a production study, tested the hypothesis that Spanish-accented speakers’ temporal patterns, i.e. segmental durations, differ from those of native English speakers in multisyllabic words. A third part, a set of analyses testing the correlation of the range in segmental durations of the Spanish-accented speakers and the range in accentedness ratings assigned by the native listeners, was attempted to test the hypothesis that the temporal deviations in the nonnative (Spanish-accented) speech are related to the perception of foreign-accentedness.

2. STUDY 1

In this perception study, the objectives were: a) to establish the relative global accentedness of the nonnative speak-

ers in this study, and b) to determine the correlation between ratings of accentedness in multisyllabic word and overall sentence condition in order to test whether the accentedness on the multisyllabic words were representative of the global accentedness across the nonnative speakers.

Ten native speakers of American-English judged accentedness on a nine-point rating scale where 1=least-foreign accented, and 9=most-foreign accented. The stimuli consisted of randomized samples of eight multisyllabic words that had been spliced from sentences that were read by 22 non-native speakers (Spanish speakers of English) and five native speakers of American-English.

The ratings of listeners on each of the eight words were pooled and the typical (median) native listener ratings of accentedness on each word were used as the speakers’ scores in the correlational analyses with the production measures as described later. Additionally, results showed that all of the eight multisyllabic words were good predictors of global accentedness, as they correlated strongly ($p=0.82$) with previously-tested accentedness ratings on overall sentences by the same listeners. Hence, these multisyllabic words were the focus of the following analyses.

3. STUDY 2

In this production/acoustic study, the above-mentioned eight multisyllabic (3, 4, and 5 syllable) target words, as recorded by 22 nonnative and the five native speakers of American English were analyzed for temporal acoustic differences. The segments measured included overall word duration, unstressed vowel duration, ratios of stressed to unstressed (S/U) vowel duration as a measure of lexical stress, Voice Onset Time (VOT) of word-initial, voiceless stop consonants and closure duration in intervocalic flaps/stops. Based on phonological descriptions of Spanish-accented English and Spanish phonological rules (MacDonald, 1989; Ortega-Llebaria, 1997), predictions were made for each of the acoustic segments measured. The Spanish-speakers of English (nonnative group) were expected to produce longer overall word durations due to an expected slower rate of speech. Voiceless stop VOT values were expected to be smaller in the nonnative group since voiceless stops in Spanish are unaspirated. Flap/closure duration of intervocalic /t/ was expected to be greater in the nonnative group, approximating durations for stops. Vocalic segmental durations were expected to be approximately

equal for stressed and unstressed syllables; thus S/U ratios were expected to be equal to 1 in the nonnative group, as predicted by the syllable-timed stress pattern of Spanish phonology.

Results showed that the nonnative speakers' productions were, on average, significantly longer than the native productions [$t(56) = -2.15, p < 0.04$]. The unstressed vowel durations were, on average, proportionately longer for the nonnative group compared to the native group. Unlike the native group, the nonnative group failed to make a sufficient temporal distinction between stressed and unstressed vowels, with S/U ratios, on average, varying from 1.00 to 2.05. VOT, on average was shorter in the nonnative group, on average, compared to the native group. Flap/closure durations were, on average, longer in the nonnative group, compared to the native group.

As expected, the nonnative speakers, as a group, showed greater variability in each of the measured segmental durations as compared to the native group. This variability in word duration lent itself well to test its correlation with the range in accentedness ratings by the native listeners (as obtained from Study 1).

4. CORRELATION ANALYSES

Each of the above segmental measures were rank-ordered and correlated with ranked median ratings of accentedness on words, using a Spearman rank-order correlation. The objective of this analysis was to determine the relationship of the temporal deviations in the nonnative group with the perceived accentedness, as judged by the native speakers.

Findings indicated that overall word duration was correlated with perceived accentedness with low to moderate strength ($p = 0.04$ to 0.56), although only one word, "committee", yielded a statistically significant relation. Stressed to unstressed vowel ratio, a measure of lexical stress, correlated positively with perceived accentedness for all but one word, although, only the correlation for the word "economic" was significant ($p = 0.80$). Deviations in VOT also correlated positively with accentedness ($p = 0.26$ to 0.36) and so did deviations in flap/closure durations ($p = 0.29$ to 0.59). While none of the VOT-accentedness correlations was statistically significant, three of the five correlations of flapped /t/ and accentedness were highly significant.

5. GENERAL DISCUSSION

The overarching goal of this research was to examine the temporal speech characteristics of native Spanish speakers of English-as-a-second-language that relate to the native English-speaking listeners' perception of accentedness. Previous studies were restricted to either describing the phonological characteristics or analyzing a select few acoustic measures of this nonnative group. Multiple acoustic parameters as they relate to perceived accentedness have not

yet been studied in a correlational design. The present study tapped several temporal characteristics of multisyllabic words, selected on the basis of previous phonological descriptions of Spanish-accented speech, as they relate to a measure of perceived accentedness. Two studies were designed to test the hypotheses that temporal deviations characterize Spanish-accented speech, and that these deviations are related to the perception of accentedness as judged by native speakers of English. The multisyllabic words used in the two studies had been found to be good predictors of global accentedness, i.e. accentedness on overall sentences. Results showed systematic temporal deviations in the nonnative group compared to the native group for each of overall word duration, unstressed vocalic duration, stressed to unstressed vowel ratios, VOT for voiceless, word-initial stops as well as for closure duration in intervocalic stops/flaps. However, overall group differences were small. Moreover, correlations tested with each of these segmental deviations with accentedness ratings showed only low to moderate strength of relationship. It is hypothesized that, while each of the measures alone does not strongly predict accentedness, some combination of these temporal deviations may account, at least in part, for native listeners' judgments of perceived accentedness.

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