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Quantifying Rhythmic Differences between Spanish, English, & Hispanic English

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QUANTIFYING RHYTHMIC DIFFERENCES BETWEEN SPANISH, ENGLISH, AND HISPANIC ENGLISH

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1. Introduction

Although sociolinguists working within the variationist tradition have become increasingly interested in the interactions between varieties of English and Spanish spoken in the United States, the overwhelming majority of studies have been either qualitatively based, or focused on the adaptation of segmental structures. Accordingly, rigorous, quantitative analyses of suprasegmental features from Spanish-English contact situations are largely underrepresented in the variationist literature. This, coupled with the fact that the West, Southwest, and major urban centers such as New York and Philadelphia have received most of the attention, has left emerging Spanish-English contact situations essentially unexamined in the Mid-Atlantic South, where core Hispanic communities are just now beginning to develop. In the past decade, North Carolina has witnessed a higher percentage of growth in its Hispanic population than any other state, and currently has the largest percentage of monolingual Spanish speakers of any state in the US. In part, these somewhat surprising statistics are a function of the limited representation of Hispanics in North Carolina a decade ago, but it is also a testament to the changing demographics of the linguistic situation in the Mid-Atlantic South at the beginning of the twenty-first century.

North Carolina's current linguistic situation provides a unique opportunity to examine the earliest stages of Spanish-English contact at nearly every level of the linguistic spectrum including the level of prosody and, more specifically, rhythm. This situation gives rise to a number of important research questions. First, is the rhythm associated with native English-speakers attainable to immigrant Spanish-speakers beyond childhood, or are the rhythmic differences between L1 and L2 too vast to overcome? How rapidly do Spanish-speaking immigrants acquire the unmarked, native-like rhythm of the contiguous English-speaking community? To what extent does the rhythm of Spanish provide substrate influence for the emerging dialects of English spoken by
Hispanics? How might the rhythm of Southern English be affecting the prosodic patterns of Spanish for speakers who live in a minority, immigrant community? And finally, what are the empirically measurable differences between Spanish, English, and the linguistic varieties resulting from the contact of the two?

In this preliminary study, I explore some of these questions by examining the rhythm from the Spanish of monolingual Spanish-speakers, the Spanish of their bilingual community cohorts, and the English of these same bilinguals. As a baseline for comparison, these data are compared to the corpus provided by Thomas & Carter (2003a, b) which contains data from native English-speaking North Carolinians. All of the participants in this study reside in the same exclusively-Hispanic neighborhood in the capital city of Raleigh, North Carolina, the location of which can be found in Figure 1.

![Map of North Carolina with Raleigh highlighted](image)

Figure 1: Location of Raleigh, NC

This community is unique because, although located in a metropolitan area, it is relatively insular in that community members interact socially and recreationally primarily with other community members. Contact occurs with extra-community members only via institutional affiliations such as work or school. Correspondingly, a clear ethnonationalistic boundary demarcates this community from the surrounding, mostly European-American, English-speaking community. Field recordings were used to collect data obtained from sociolinguistic interviews which lasted from 60 to 90 minutes. One-on-one interviews were conducted in English, Spanish, or both, though code-switched data were not analyzed for this study. A demographic profile of the speakers considered in the study is located in Table 1. It should be noted that all participants in this study are originally from Mexico City or the Mexican state of Colima and that no participant has lived anywhere in the US other than North Carolina.

<table>
<thead>
<tr>
<th>Speaker</th>
<th>Age</th>
<th>Sex</th>
<th>Length of Res.</th>
<th>Lg. Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>AG</td>
<td>11</td>
<td>female</td>
<td>3.5 years</td>
<td>bilingual</td>
</tr>
<tr>
<td>MB</td>
<td>11</td>
<td>male</td>
<td>8 years</td>
<td>bilingual</td>
</tr>
<tr>
<td>LB</td>
<td>15</td>
<td>female</td>
<td>8 years</td>
<td>bilingual</td>
</tr>
<tr>
<td>CB</td>
<td>19</td>
<td>male</td>
<td>8 years</td>
<td>bilingual</td>
</tr>
<tr>
<td>BG</td>
<td>18</td>
<td>female</td>
<td>3 months</td>
<td>monolingual</td>
</tr>
<tr>
<td>FG</td>
<td>18</td>
<td>female</td>
<td>3 months</td>
<td>monolingual</td>
</tr>
<tr>
<td>JV</td>
<td>27</td>
<td>male</td>
<td>6 years</td>
<td>monolingual</td>
</tr>
<tr>
<td>CA</td>
<td>30</td>
<td>female</td>
<td>4 years</td>
<td>monolingual</td>
</tr>
</tbody>
</table>

Table 1: Demographic Profile of Raleigh Sample

2. Theoretical Background

Early studies on rhythm, particularly Pike (1945) and Abercrombie (1967), stressed a strict dichotomy between languages that were considered stress-timed, which included Germanic languages, Slavic languages, and Arabic, and those considered syllable-timed, which included, among others, the Romance languages. Syllable-timed languages were reported to have syllables of nearly equal duration that occurred at regular intervals, while stress-timed languages exhibited a wider range of syllable durations, with syllables recurring at irregular intervals.

It was the original stress/syllable dichotomy that led to the classification of English and Spanish as stress- and syllable-timed languages, respectively. Conventional thinking on rhythmic timing prevailed until the 1980s, when more rigorous analyses of rhythm problematized the dichotomy, leading to a proposal of a continuum model of rhythm. In this conception, stress-timed languages are at one pole and syllable-timed languages at another, allowing for the infinite gradation of rhythm across linguistic systems. This model seemed effective in accounting for "intermediate languages" (Ramus, Neupauer, & Mehler 1999) such as Catalan and Polish, which may exhibit syllable structures characteristic of either stress- or syllable-timed languages but also display segmental phenomena such as vowel reduction typically associated with one rhythmic variety or the other. Further evidence for a continuum model instead of a dichotomous model comes from work by Borzone de Mântique & Signorini (1983), who found unequal syllable duration in Spanish
comes from Dasher & Bolinger (1983), who propose that a language’s timing is more dependent on its segmental phonological features, such as consonant-vowel distribution, lexical stress, and the presence or absence of syllable reduction, than on the syllable structure itself. Findings from studies in the 80s demonstrate that the earlier thinking was based on a spurious dichotomy and that, rather than taxonomizing linguistic varieties into a categorical or binary set, we should instead consider varieties as being ‘more or less’ syllable-timed or ‘more or less’ stress-timed.

3. PVI Methodology

One of the primary reasons for the debate among phoneticians and phonologists over the appropriate rhythmic model and resulting rhythmic taxonomy of languages has had to do with a lack of a standard, accepted methodology for quantifying differences. An appropriate methodology has been elusive since it would have to consider a number of factors that influence rhythmic production, namely syllable duration and interval differences.

Despite these challenges, Low & Grabe (1995) introduced the Pairwise Variability Index (PVI) which compares pairs of syllables while taking into account speaking rate. In this method, measurements for syllable duration are taken and each syllable is then compared with the adjacent syllables by using the PVI equation (Figure 2). The result is an index of scores that indicate the degree of syllable- or stress-timing found in examined varieties. High scores indicate more stress timing while lower scores indicate more syllable timing. Using this method, Low & Grabe demonstrated that Singapore English was substantially more syllable-timed than standard British English, as was expected based on prior impressionistic accounts. The PVI method was soon adopted by several phoneticians and sociolinguists eager to illuminate differences in rhythm among different languages and dialects. Gut et al. (2002), for instance, used the PVI method coupled with their own ‘rhythm ratio’ (RR) to examine rhythmic differences between three West African tonal languages.

\[
\text{PVI} = \frac{\text{syllableA} - \text{syllableB}}{\text{syllableA} + \text{syllableB}}
\]

Figure 2: PVI Formula (Low & Grabe 1995)

Among those using PVI to explore cross-dialectal differences were Low, Fought & Grabe (1997), who found that speakers of Spanish from the US and Fought & Fought (2003), who compared Hispanic English with the English of the adjacent Anglo California community. Fought & Fought’s (2003) application of PVI revealed more syllable timing for the Hispanics than for the Anglos, though syllable timing was concentrated in the first five syllables of an utterance. Likewise, they found a similar localization of syllable timing in Mexican Spanish, signaling a link between the two varieties. In Thomas & Carter (2003a, b), we used the PVI method to examine rhythm production among Southern African American and European Americans and found that no significant differences exist among the two.

In this study, following the work of Thomas & Carter (2003), I adopt Low & Grabe’s PVI methodology. Field recordings from the Raleigh sample were digitized and spectrograms were analyzed using PRAAT phonetics software. Duration measurements were taken at the onset and offset of the vocalic nucleus of the syllable, instead of at the onset and offset of the syllable itself. This nucleus measuring was necessary because of the use of field recordings that often included non-linguistic background noise, making consonant identification difficult if not impossible in some cases. For each speaker, over 200 comparisons were made in each language, yielding over 2,500 measurements for this study.

For the English data, all cases of the canonical diphthongs /ai/, /oi/, and /aw/ were considered as one measurement. Further, because the retroflex English /l/ and the liquid English /r/ are nearly impossible to separate from the preceding vocalic segment, these consonants were considered with the syllabic nucleus as one measurement. For the Spanish data, all diphthong combinations were considered as one measurement, except when split in lexical items where an orthographic accent would be needed. The issue of the sinalefa for the Spanish data was addressed on a case-by-case basis. Where clear diphthongization occurred across word boundaries, one measurement was taken, but when spectral cues indicated separate monophthongs, two measurements were taken. In cases of syllable deletion as in mija for mi hija and lambrugossa for la hamburgesa, the chain of comparison was not broken and no zero value was assigned for the ‘missing’ syllable. For both languages, the pre-pausal syllable was omitted from analysis because of the effects of pre-pausal lengthening. When the pre-pausal syllable was unstressed, the entire syllabic foot was omitted.

4. Results

Figure 3 provides a scatter plot of the aggregate PVI results for individuals from each of the five groups considered: Spanish monolingual Spanish

and English monolingual English.
American and European American North Carolinians provided by Thomas & Carter (2003a, b). The points labeled 'Spanish' in this plot include both the bilinguals and the monolinguals. It should be noted that the lack of previous qualitative work on rhythm leaves us with no clear, external baseline data to which we can compare the English of the native North Carolinians. PVI results from the studies of English varieties mentioned earlier are not comparable due to methodological differences in measurement.

Figure 3: Mean PVI Results for All Speakers, Including Benchmark North Carolinians

Clearly, the mean PVI scores for the Hispanic English speakers and Spanish speakers fall well below those for the native English speaking North Carolinians, indicating some difference in rhythmic production among the different varieties. Figure 4 provides the mean PVI group scores for each of the groups, including the benchmark African American and European American North Carolinians. The raw scores are presented in Table 2. Here again, Figure 4 clearly shows differences in rhythmic production among the groups considered, with the benchmark groups having scores above .5, the Hispanic English group having scores above .4, and the combined Spanish group at well below .3.

Table 2: Mean PVI Group Scores

<table>
<thead>
<tr>
<th>Group PVI</th>
<th>Af-American</th>
<th>Euro-American (Eng)</th>
<th>Hispanic</th>
<th>All Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td>.5515</td>
<td>.5304</td>
<td>.4264</td>
<td>.3798</td>
<td></td>
</tr>
</tbody>
</table>

As we have seen, prosodic variation at the group level is evident but what type of variation might we expect within the groups? Figure 5 provides the mean PVI scores in each language for each of the four bilinguals considered in the study thus far. The raw scores, total number of comparisons, and the standard deviations are located in Table 3.
We should now consider CB, the 18 year old brother of MB and LB. CB's Spanish production is in line with the other bilinguals, but his English production is much lower. Of all the bilinguals, CB received the greatest amount of his compulsory education in Mexico and because of intra- and inter-ethnic conflict at his North Carolina high school, dropped out of school at the age of 16. Over the past two years, he has worked alongside other Hispanics in construction, and though his peer group is exclusively Hispanic and is characterized by frequent code-switching to English, the dominant language is Spanish. It is impossible to say at this point if the more marked pattern is the result of not mastering the English pattern even at the level of his community cohorts, or if the marked pattern is an assertion of his Hispanic identity.

Figure 6 provides the PVI results for the Spanish monolinguals from the Raleigh community. The bilingual results are reproduced here (marked * ) for the sake of comparison. The raw PVI scores, the total number of comparisons, and the standard deviations are given for each monolingual speaker Table 4.

Table 3: Statistical Information for Raleigh Bilinguals

<table>
<thead>
<tr>
<th>Speaker</th>
<th>N</th>
<th>PVI (Eng)</th>
<th>Std. Dev. (Eng)</th>
<th>N</th>
<th>PVI (Span)</th>
<th>Std. Dev. (Span)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AG</td>
<td>213</td>
<td>.4447</td>
<td>.3262</td>
<td>201</td>
<td>.2797</td>
<td>.2348</td>
</tr>
<tr>
<td>MB</td>
<td>236</td>
<td>.4440</td>
<td>.3415</td>
<td>205</td>
<td>.3127</td>
<td>.2601</td>
</tr>
<tr>
<td>LB</td>
<td>226</td>
<td>.4538</td>
<td>.3163</td>
<td>206</td>
<td>.2762</td>
<td>.2477</td>
</tr>
<tr>
<td>CB</td>
<td>216</td>
<td>.3596</td>
<td>.2533</td>
<td>238</td>
<td>.2953</td>
<td>.2422</td>
</tr>
</tbody>
</table>

Though the sample size is relatively small, some instructive points about rhythm can be made. First, it is clear that each of the speakers has different rhythmic productions for each of his/her two languages, though to somewhat varying degrees. Second, there is much more uniformity across the English set than across the Spanish one. AG, MB, and LB have nearly identical PVI scores in English but exhibit more variation in their Spanish productions. This may be the result of an orientation towards a perceived English norm or 'target' acquired in school or the ESL classroom, though this is somewhat unlikely given the different educational experiences of the three speakers. Or, perhaps the speakers do not learn stylistic variation at the prosodic level because acquiring the formal structures of the language is already challenging enough. This uniformity may also be the result of some intra-community English norm and may indicate the emergence of a new Hispanic English dialect for the Raleigh area (Wolfram, Carter, & Moriello 2004).

This possibility seems to be evidenced most by MB, an eleven year old male who has lived in the community for 8 years. Of all the speakers, it seems he would have the most opportunity to acquire or accommodate to English prosody because of his relatively long length of residency and early age of arrival, but his PVI score is in line with LB, his older sister, who received more schooling in Mexico, and with AG, who moved to the community just three years ago. Only MB exhibits a PVI score above the .3 level for the Spanish production, while the other three speakers have productions between .27 and .29. This may signal some possible influence by the English pattern onto the Spanish one. This explanation, though preliminary, seems viable, as MB, more than any other speaker, has spent the overwhelming majority of his life in the Raleigh community. This finding is instructive for linguists interested in the ways in which the children of Spanish-speaking immigrants acquire Spanish.

Figure 6: Mean PVI Scores for All Spanish-speakers
Though no clear pattern is easily discernible, some trends can be noted. First, there is a nominal difference in the group means for the two groups, as the bilingual speakers have a mean above .29 while the Spanish monolinguals have a lower score at above .26. This difference may signal some influence from the English pattern onto Spanish prosody. Thomason & Kaufman (1985) entertain this possibility in their theory of language shift. They write: "Shifting speakers maintain their original language’s prosodic patterns if they haven’t learned those of the TL [target language]. But immigrants who have succeeded in learning the prosodic patterns of a language their group is shifting to may use those patterns so often in speaking the target language, and their own so seldom (or with a feeling that low prestige adheres to the native language), that they replace the native patterns with the ones borrowed from the target language." Accommodation at this level is unlikely since there is no evidence of language shift or low prestige per se, but many of the young bilinguals do show a heightened orientation toward American values and, indeed, toward English language use. Still another possibility is that because the bilingual speakers tend to be younger with, correspondingly, a much younger age of arrival in North Carolina, the Spanish they acquired in the Raleigh community is prosodically different from the Spanish they would have acquired had they remained in Mexico.

5. Conclusions

Although this study is still preliminary, several points about rhythm production in Spanish and English and more generally about language acquisition are emerging. First, this study shows that there are some clear differences between the rhythm of Spanish and the rhythm of English, once again confirming our previous expectations based on impressionistic accounts, as well as the findings of Ramus et al. 1999. It is evident that this variety of Mexican Spanish is indeed more syllable-timed than English, and English is more stress-timed than this variety of Spanish, but we should be cautious about assigning one label or the other to either language. The data from each language are only noteworthy when considered in relation to each other. In other words, at this point there is no exogenous norm for comparison using this application of the PVI methodology. Examinations of other Romance languages using this methodology are necessary in order to further our understanding of rhythm in these languages. Further, examinations of rhythm in diasporic varieties of the Romance languages can provide crucial insights for influence rhythm output. In Thomas & Carter (2003), we found that syllable reduction played an important role in the stress-timing of English. The more syllables are reduced, the difference in duration among syllables increases, leading to higher PVI scores and, correspondingly, more stress-timing. Syllable reduction was much less common in the English of the native Spanish speakers, and even less common in the Spanish data. Accordingly, we may expect lower PVI scores indicative of more syllable-timing in other varieties of Spanish that are even less prone to syllable reduction than Mexican Spanish.

The findings from this study also support Borzone de Manrique & SIGNORELLO (1983) finding that Spanish is characterized by differences in syllable duration. If Spanish were ideally syllable timed, we would have seen PVI scores of zero instead of scores in the .2 range. The findings here do not support the findings of Fought & Fought (2003) who found that California Hispanic English was more syllable-timed than the English of the contiguous European American community, but only for the first five syllables of an utterance. The data from the Raleigh community show no evidence of clustering at any fixed location within the utterance, neither for the English nor the Spanish data.

This study also provides some important insights for sociolinguists and dialectologists interested in new dialect formation and the origins of Hispanic English. The data provide signs of Spanish substrate influence on the English of the Hispanic group, as evidenced by the intermediate rhythm production by the bilinguals. Additionally, the uniformity of English rhythm production may signal the emergence of new varieties of English spoken Hispanics. Longitudinal studies will be needed to determine the impact of these incipient communities on future generations of Hispanics, especially on those born in the US.

Further investigation is needed to determine how interactions with other segmental and suprasegmental features, particularly intonation, affects rhythm production (Fought & Fought 2003). More quantitative work on rhythm is also needed to explore cross-dialectal differences of Spanish. Though this variety of central Mexican Spanish is more syllable-timed than the English of North Carolina, it nevertheless may be more stress-timed than other varieties of Spanish, both Castilian and Latin American.

Finally, it is evident that with technological advancements in acoustic phonetics, laboratory examinations of non-segmental features are more feasible than ever before. Reliance on longstanding impressionistic assumptions is no longer necessary in the face of cogent laboratory methodologies. Further research is certainly needed to understand the complexity of rhythm in Spanish and English.
only rhythm in the Romance languages, but also to a host of suprasegmental features that previously eluded the quantitative analysis of phoneticians.

REFERENCES


