Syllable Reduction and Articulation Rate in Spanish and Portuguese

Stefanie Voigt, Anja Schüppert, Charlotte Gooskens
Introduction

Spanish and Portuguese are closely related languages = generally mutually intelligible to a certain extent

Jensen (1989) found an **asymmetry** in mutual intelligibility of South-American Spanish (50%) and Portuguese (60%)

**Higher articulation** rate shows **negative effects** on intelligibility.

When sentences are produced **quickly**, articulation becomes **less clear** = reduced pronunciation.
Introduction

The hypothesis for the following study is:

Portuguese shows a higher articulation rate which results in a larger number of syllable deletions compared to Spanish.
# Linguistic Similarities/Differences

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Linguistic Similarities/Differences

Dauer (1983) discards the concept of ‘syllable-stressed’ and suggests a continuum where languages are classified as more or less close to a base that she calls ‘stress based’.
Linguistic Similarities/Differences

Distribution of languages %V and Variability of Cints

Average proportion of vocalic intervals and the average standard deviations of consonantal intervals in a three-dimensional space

Rasmus et al. (1999), Vigário, Marina, Sónia Frota, & Maria João Freitas (2003)
# Linguistic Similarities/Differences

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Method/Participants

- Radio podcasts of the national radio of Spain and Portugal
- Cover various topics, such as politics, economics, cooking, etc.
- Speakers of standard variety
- All pauses longer than 150ms removed
- Recordings were cut to be between 15s and 40s in duration

<table>
<thead>
<tr>
<th>Language</th>
<th>n</th>
<th>female</th>
<th>male</th>
<th>total time in min</th>
</tr>
</thead>
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<tr>
<td>Spanish</td>
<td>24</td>
<td>12</td>
<td>12</td>
<td>15.17</td>
</tr>
<tr>
<td>Portuguese</td>
<td>21</td>
<td>10</td>
<td>11</td>
<td>12.71</td>
</tr>
</tbody>
</table>
Speech Rate/Articulation Rate

- **Speech rate** = number of items (syllables, words, etc.) produced per time unit (seconds, minutes, etc.) including pauses

- **Articulation rate** = number of entities (syllables, words, etc.) produced per time unit (seconds, minutes, etc.) excluding pauses
Measurements

- De Jong & Wempe (2009) developed a script for Praat to automatically mark and count **phonic syllables**

- Spanish fragment: (en-Es-pa-ña-el-con-gre-so-ha-a-pro-ba-do) (13)

- **Canonical syllables** were counted by speakers of the individual languages according to their entries in the dictionary
Articulation Rate

• **Canonical articulation rate** = number of canonical syllables per second

• **Phonetic articulation rate** = number of phonetic syllables per second

• **Reduction rate** = canonical syllables per s – phonetic syllables per s
Results: Canonical Articulation Rate

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<tr>
<th>Language</th>
<th>Utterance length (s)</th>
<th>No. of canonical syllables</th>
<th>Articulation rate (canonical syllables/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish</td>
<td>813.8</td>
<td>5284</td>
<td>6.50</td>
</tr>
<tr>
<td>Portuguese</td>
<td>818.6</td>
<td>5411</td>
<td>6.60</td>
</tr>
</tbody>
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Difference of canonical syllables per second not significant \((t(43)=0.246, \ p=0.639)\)
Results: Phonetic Articulation Rate

<table>
<thead>
<tr>
<th>Language</th>
<th>Utterance length (s)</th>
<th>No. of phonetic syllables</th>
<th>Articulation rate (phonetic syllables)</th>
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</thead>
<tbody>
<tr>
<td>Spanish</td>
<td>813.8</td>
<td>3512</td>
<td>4.32</td>
</tr>
<tr>
<td>Portuguese</td>
<td>818.6</td>
<td>3135</td>
<td>3.94</td>
</tr>
</tbody>
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Difference of phonetic syllables per second is **significant** ($t(43)=0.018$, $p=0.010$)
Reduction Rate

The reduction rate of Spanish (M=2.19, SD=0.848) is significantly lower than the reduction rate of Portuguese (M=2.65, SD=0.623): t(43)=0.229, p=0.040.
Discussion

- Spanish and Portuguese speakers do speak at the same pace canonically but on the phonetic level Portuguese speakers reduce more syllables per second:
  - Portuguese speakers eventually produce longer but fewer syllables per second.
  - Phonetic syllables in Portuguese probably carry more phonetic information individually than Spanish ones, are more likely to have more phonemes.
Discussion

1. Reduction
• Spanish mostly consonants
• Portuguese vowels as well as consonants (post-stressed and final position, unstressed vowels reduced or voiceless and can be elided in fast speech) = more possibilities for syllable reduction in general.

2. Rhythm
Spanish = syllable timed, Portuguese = between syllable-timed and stress-timed
= makes reduction for Spanish, in general, less possible.
Possible effects on mutual intelligibility

- Jensen (1989) found an **asymmetry** in mutual intelligibility of South-American Spanish (50%) and Portuguese (60%)
- Linguistic **variables**, such as phonetic features, and in this case **articulation rate**, can be **predictors** for mutual intelligibility of closely related languages.
- The **higher syllable reduction rate** of Portuguese might be the **factor** which **causes** or boosters the **asymmetry** in mutual intelligibility of Spanish and Portuguese.
Possible effects on mutual intelligibility

• We hypothesize that European Spanish and Portuguese also show an asymmetric mutual intelligibility for an average speech rate.

• This hypothesis will be tested in a future experiment.
Thank you for your attention
References


