



Syllable Reduction and Articulation Rate in Spanish and Portuguese

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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

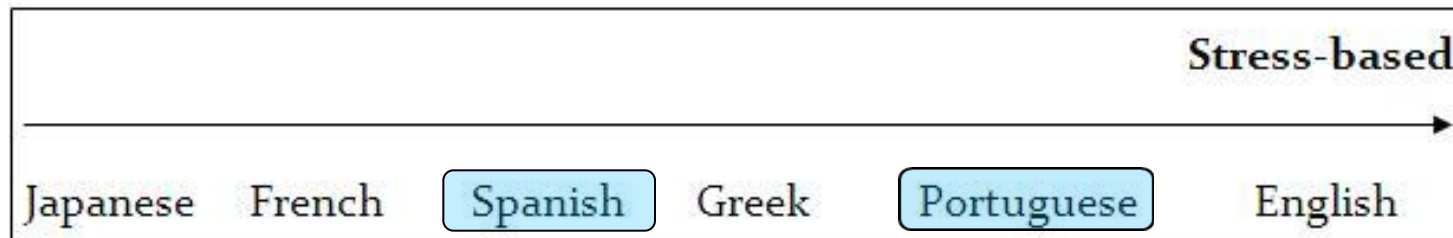
	<i>Spanish</i>	<i>Portuguese</i>
Rhythm	Syllable timed	between stress-timed and syllable-timed
Phoneme inventory	Five phonemic vowels	Fourteen phonemic vowels
Reduction	Mostly (intervocalic and final) consonant reduction	Portuguese weakens unstressed vowels - often reduced or voiceless and can be elided in fast speech

She discards the concept of 'syllable-stressed' and suggests a continuum where languages are classified as more or less



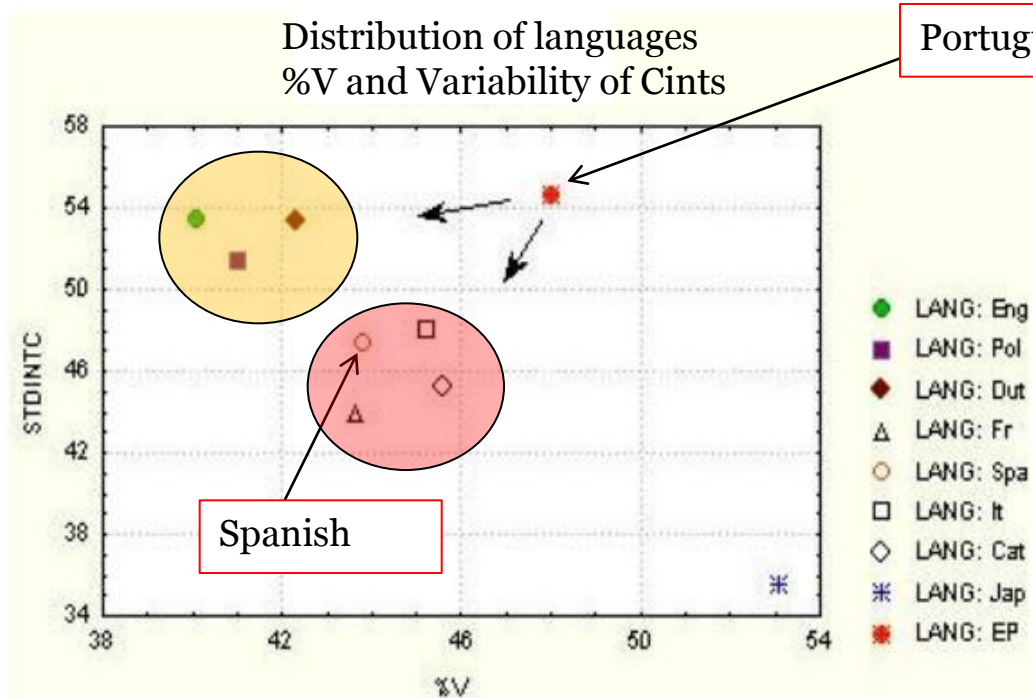
Linguistic Similarities/Differences

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



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

Language	n	female	male	total time in min
Spanish	24	12	12	15.17
Portuguese	21	10	11	12.71



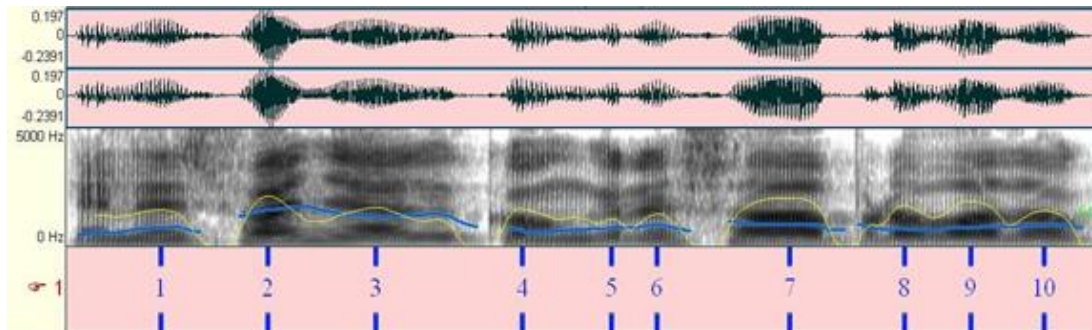
Speech Rate/Articulation Rate

- **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 **phonetic 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

Language	Utterance length (s)	No. of canonical syllables	Articulation rate (canonical syllables/s)
Spanish	813.8	5284	6,50
Portuguese	818.6	5411	6,60

Difference of canonical syllables per second
not significant ($t(43)=0.246$, $p= 0,639$)



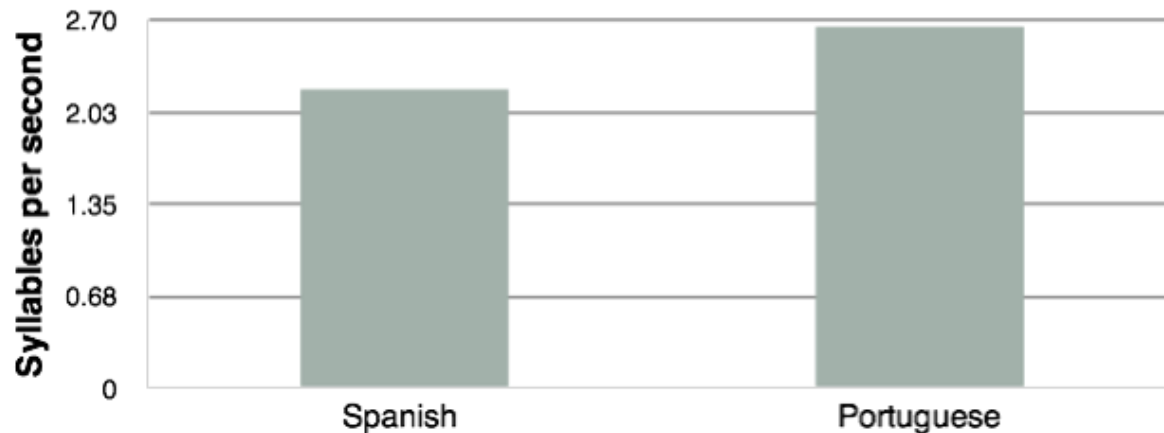
Results: Phonetic Articulation Rate

Language	Utterance length (s)	No. of phonetic syllables	Articulation rate (phonetic syllables)
Spanish	813.8	3512	4.32
Portuguese	818.6	3135	3.94

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 boosts 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.



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Thank you for your attention

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References

- Boersma, P., Weenink, D. (2008). Praat: Doing phonetics by computer. Institute of Phonetic Sciences, University of Amsterdam. <http://www.praat.org/>
- Dauer, R. (1983). Phonetic and phonological components of language rhythm. Proceedings of 11th International Congress of Phonetic Sciences, 447-450.
- Jensen, John B. (1989) On the Mutual Intelligibility of Spanish and Portuguese, *Hispania*, 72.
- Ramus, F., Nespors, M. & Mehler, J. (1999) Correlates of linguistic rhythm in the speech signal. *Cognition*, 73, 265-292.
- Schüppert, A., & Hilton, N. H., & Gooskens, C. & Heuven, V. J. van. (2012). Syllable deletion in contemporary Danish. *Copenhagen studies in Language*.
- Vigário, Marina, Sónia Frota, & Maria João Freitas (2003), 'From Signal to Grammar: Rhythm and the Acquisition of Syllable Structure'. In: B. Beachley, A. Brown & F. Conlin, (eds.), BUCLD 27: Proceedings of the 27th annual Boston University Conference on Language Development. Somerville, MA: Cascadilla Press. Pp. 809–821.