

# Speech rhythm and sentence type: Analyzing the durational properties of Olivenza Portuguese, Olivenza Spanish, and Castilian Spanish

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## ABSTRACT

The present paper compares the rhythmic properties of two contact varieties, Olivenza Portuguese (OP) and Olivenza Spanish (OS), with those of Castilian Spanish (CS). Based on the analysis of a corpus comprising recordings of declarative, interrogative, and imperative sentences, we show that OS generally displays intermediate %V, VarcoV, and VnPVI scores between the ones for CS and OP. The greater or lesser differences between the three varieties are explained by referring to phonological properties such as (presence or absence of) vowel reduction, vowel and consonant elision, and specific lengthening effects. Our results suggest that sentence modality contrasts seem to be conveyed by rhythmic differences in the varieties under investigation: While durational differences between declaratives and imperatives were found in all of the three varieties (the differences being greater in OP and OS than in CS), declaratives and interrogatives only differ from one another in OP and OS.

**Keywords:** speech rhythm, lengthening effects, sentence types, language contact.

## 1. INTRODUCTION

Olivenza is a small town located in the border area between Extremadura (Spain) and Alentejo Alto (Portugal). It was part of Portugal between 1297 and 1801 (with an interruption between 1657 and 1668); after its incorporation into Spain (1801), Spanish became the official language of administration, education, and religion [17, 28, 29]. It is claimed that the majority of Olivenza's speakers were already bilingual at the end of the 19<sup>th</sup> century [27, 32]. Since Spanish became more dominant in course of time, OP was no longer being learned as a mother tongue from the 1950ies on [17, 18]. Nowadays, all speakers of OP are bilingual and older than 60 years.

Due to the long-lasting contact between Portuguese and Spanish in Olivenza, the local varieties, i.e., OP and OS, are traditionally said to be influenced by one another [5, 17, 18, 25, 26]. However, the durational properties of OP and OS have not been investigated so far. The present study attempts to fill this research gap.

Before presenting the goals and the hypothesis of our study, we offer a brief description of the rhythmic properties of CS and Standard European Portuguese (SEP). CS is a typical syllable-timed language which displays a rather high proportion of vocalic material (%V) and rather low durational variability of both vocalic (V) and consonantal (C) intervals; see the discussion in [1, 9, 11, 15, 23, 24, 33], among many others. However, SEP has a mixed rhythm in that its %V scores are comparable to those for CS, but in presenting greater values for the durational variability of both V and C intervals [6, 8]. Moreover, CS lacks vowel reduction and deletion of reduced vowels, in contrast to SEP [6, 23].

Our goal is twofold: First, to compare the speech rhythm of various sentence types (declaratives, yes-no questions, wh-questions, and imperatives) in OP, OS, and CS in order to depict the durational differences and similarities between the varieties and to find out which kind of rhythmic patterns typical of Spanish or Portuguese show up in the two contact varieties, OP and OS. Second, to compare the rhythmic properties of different sentence types in order to examine if sentence modality contrasts are conveyed by durational effects in the varieties studied.

On the basis of the findings on CS and SEP presented above and given the possibility of transfer from Spanish to Portuguese and vice versa, we hypothesize that the scores for the proportion of vocalic material and the variability of V intervals for OS are situated between the ones for CS and OP.

## 2. METHODOLOGY

### 2.1. Speakers

We analyzed material from 15 subjects in total: five bilingual speakers of OP (two ♀, three ♂, ages: 68–76, mean age: 73.4), five monolingual speakers of OS (two ♀, three ♂, ages: 18–32, mean age: 25), and five monolingual speakers of CS (two ♀, three ♂, ages: 26–34, mean age: 29.2). The speakers of the two contact varieties (OP and OS) were born and raised in Olivenza and lived there throughout their life (with brief interruptions). The CS speakers were born in various Castilian cities (Gijón, Valladolid, Madrid); all of them grew up in the Spanish capital.

## 2.2. Material

The corpus analyzed consists of semi-spontaneous speech data we gathered using the intonation survey proposed by [22], an inductive method that consists of confronting the speakers with a series of hypothetical everyday situations to which they are supposed to react verbally. The material comprises 466 intonational phrases (IPs) in tonal, broken down as follows: neutral and biased declaratives (OP: 65, OS: 62, CS: 61 (number of IPs per variety)); neutral and biased yes-no questions (OP: 36, OS: 38, CS: 43); neutral and biased wh-questions (OP: 34, OS: 36, CS: 37); and imperatives, including both commands and requests (OP: 16, OS: 18, CS: 20).

## 2.3. Segmentation and rhythm metrics

The whole material was segmented into V and C intervals using *Praat* (Version 5.3; [3]). Among the phonetic criteria applied for the segmentation, it is worth mentioning the following: The boundaries between V and C intervals were placed at the point of zero crossing of the waveform and defined on the basis of formant structure and pitch period [33]. Following [11] and [33], we included pre-pausal and phrase-final intervals in the analysis to capture possible lengthening effects. Glides were segmented as vocalic material if there was no friction attested in the data [11]. The beginning of plosives and affricates following a pause was set at 0.05 s before the burst of the plosive, given that their boundaries cannot be defined on the basis of the aforementioned criteria [19]. Material affected by any kind of speech disfluency and silent pauses were excluded from the counting.

For all sentence types we calculated the proportion of V material in the speech signal (%V; [24]) and the durational variability of vocalic (VarcoV and VnPVI; [11, 33]) and consonantal (VarcoC, CrPVI, and CnPVI; [7, 11, 14]) intervals. The corresponding scores were obtained using the software *Correlatore* [16]. Since various studies have shown that %V, VarcoV, and VnPVI are able to capture rhythmic differences among languages [e.g., 15, 23, 33], the varieties under discussion are compared over the %V/VarcoV plane.

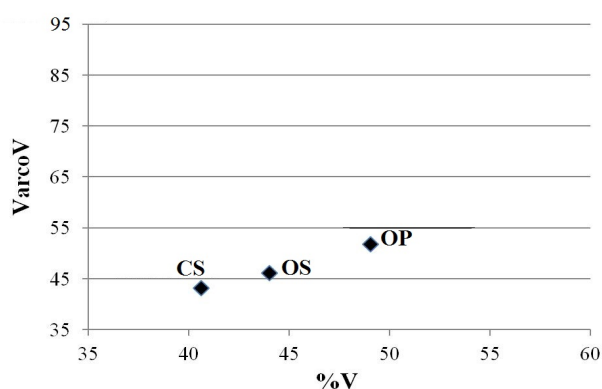
To check the statistical significance of the results, we ran a Bonferroni test, which offers a multiple comparison of the rhythmic values for each variety.

## 3. RESULTS

In what follows we present the results obtained from the analysis performed on the recordings of the declaratives, the yes-no questions, the wh-questions, and the imperatives in OP, OS, and CS.

According to the results of the analysis performed on the declaratives plotted in Figure 1, OS shows intermediate %V and VarcoV values between the ones for CS and OP. As shown in Table 1, OP exhibits higher VnPVI scores than those for OS and CS. Regarding the variability of C intervals, the three varieties display almost the same values for both VarcoC and CnPVI. Statistically significant differences were found between all the three varieties for %V (OP vs. CS  $p < 0.001$ , OP vs. OS  $p = 0.001$ , and OS vs. CS  $p = 0.020$ ) and between OP and OS for CrPVI ( $p = 0.012$ ).

**Figure 1:** %V/VarcoV values for the declaratives for OP, OS, and CS.



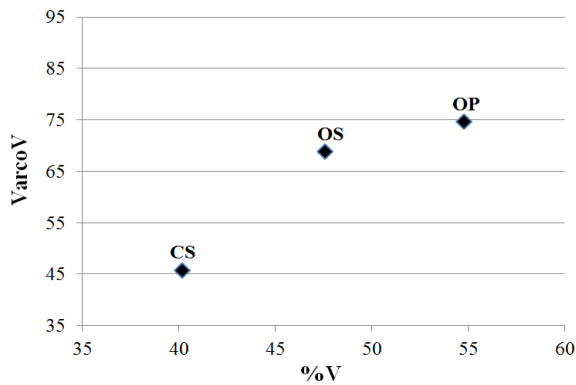
**Table 1:** Rhythmic values for the declaratives for OP, OS, and CS (mean values).

	%V	VarcoV	VarcoC	VnPVI	CrPVI	CnPVI
OP	49	51.8	41.1	43	45.2	46.8
OS	44	46.1	42.6	37.3	37.5	45.7
CS	40.6	43.2	43.7	37.5	41.5	45.3

As for the yes-no questions, Figure 2 and Table 2 show that OS exhibits intermediate %V, VarcoV, and VnPVI values situated between the ones for CS and OP (see the scores presented in the non-shaded rows of Table 2). Nevertheless, we observe considerable differences between the %V, VarcoV, and VnPVI scores for the yes-no questions in both OP and OS as compared to those for the declaratives. This is due to the fact that OP and OS differ from CS in lengthening the IP-final syllables in yes-no questions. Such lengthening effects clearly have an impact on speech rhythm, given that the greater durations of the IP-final syllables are reflected in higher %V, VarcoV, and VnPVI scores. When the IP-final syllables are excluded from the counting, the %V, VarcoV, and VnPVI values for CS largely remain unchanged (see the scores presented in the shaded rows of Table 2). In contrast, OP and OS exhibit considerably lower values for

%V and for the variability of vocalic intervals (i.e., lower VarcoV and VnPVI scores; see the shaded rows of Table 2). Regarding the variability of C intervals, the three varieties display quite similar scores for CrPVI across both conditions (i.e., including or excluding the IP-final syllables). Concerning the statistical analysis for the first condition, we found statistically significant differences between the three varieties for %V (OP vs. CS  $p < 0.001$ , OP vs. OS  $p = 0.007$ , and OS vs. CS  $p = 0.006$ ), between OP and CS for VarcoV, ( $p = 0.042$ ), between OP and OS for VarcoC ( $p = 0.029$ ), between the contact varieties and CS for VnPVI (OP vs. CS  $p = 0.002$  and OS vs. CS  $p = 0.023$ ), and between OP and the Spanish varieties for CnPVI (OP vs. CS  $p = 0.023$  and OP vs. OS  $p = 0.008$ ).

**Figure 2:** %V/VarcoV values for the yes-no questions for OP, OS, and CS.



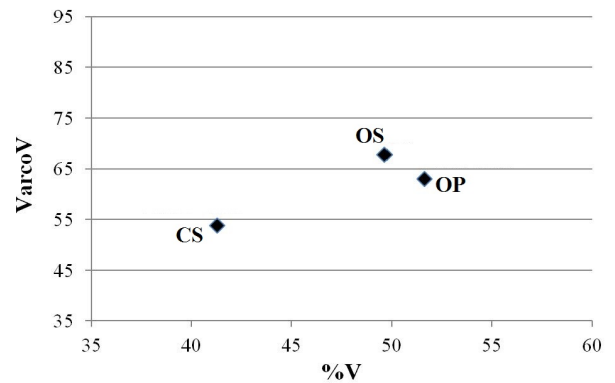
**Table 2:** Rhythmic values for the yes-no questions with (non-shaded rows) and without the IP-final syllables (shaded rows) for OP, OS, and CS (mean values).

	%V	VarcoV	VarcoC	VnPVI	CrPVI	CnPVI
OP	54.8	74.7	36.1	61.2	36.8	41.6
	46.7	44.6	35.1	43.1	35.9	42.7
OS	47.6	68.9	43.7	56.1	38.9	49.2
	43.5	47	38.8	46.2	34	46.2
CS	40.2	45.8	39.6	43.6	37.1	48
	40.4	42.6	37.5	38.9	34.2	46

Regarding the wh-questions, OP and OS pattern together in showing notably higher %V, VarcoV, and VnPVI scores than the ones for CS (see Figure 3 and Table 3). The high values can also be traced back to the lengthening of the IP-final syllables. Nevertheless, the lengthening is stronger in the yes-no questions for both contact varieties. As for the variability of C intervals, OP exhibits the highest VarcoC, CrPVI, and CnPVI values (see Table 3). We found statistically significant differences

between the contact varieties and CS for %V (OP vs. CS  $p < 0.001$  and OS vs. CS  $p < 0.001$ ), between OS and CS for VnPVI ( $p = 0.007$ ), and between OP and CS for CrPVI ( $p = 0.027$ ).

**Figure 3:** %V/VarcoV values for the wh-questions for OP, OS, and CS.

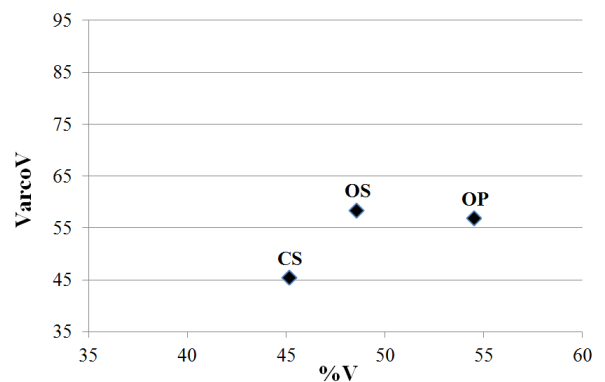


**Table 3:** Rhythmic values for the wh-questions for OP, OS, and CS (mean values).

	%V	VarcoV	VarcoC	VnPVI	CrPVI	CnPVI
OP	51.6	63	47.8	52.9	47.9	47
OS	49.6	67.8	42.9	57.2	35.2	44.2
CS	41.3	53.8	37.8	43.4	33.5	41.7

According to the results of the analysis performed on the imperatives presented in Figure 4 and Table 4, OS shows intermediate %V and VnPVI scores situated between those for CS and OP on the one hand and the highest VarcoV values on the other. As for the variability of C intervals, OS exhibits (slightly) higher scores for VarcoC, CrPVI, and CnPVI than the ones for OP and CS. We found statistically significant differences between OP and CS for %V ( $p = 0.047$ ).

**Figure 4:** %V/VarcoV values for the imperatives for OP, OS, and CS.



**Table 4:** Rhythmic values for the imperatives for OP, OS, and CS (mean values).

	%V	VarcoV	VarcoC	VnPVI	CrPVI	CnPVI
OP	54.5	56.9	35.3	54.1	43.8	43.6
OS	48.5	58.5	39.8	50.6	44	50.3
CS	45.1	45.5	35.9	38.9	41.4	48

By and large, the results confirm our hypothesis, in that OS displays intermediate scores between those for CS and OP for %V (all sentence types), for VarcoV (declaratives and yes-no questions), and for VnPVI (yes-no questions and imperatives).

#### 4. DISCUSSION

To explain the greater or lesser differences between the rhythmic scores, we take into account the following phonotactic and/or prosodic properties: vowel reduction, vowel and consonant elision, lengthening of nuclear and phrase-final syllables.

Regarding the %V, VarcoV, and VnPVI values for the declaratives, the differences between CS and OS may be explained by the fact that the intervocalic approximants [β ð γ] were elided more frequently in OS than in CS on the one hand and that OS has non-systematic vowel reduction on the other [10]. The differences between OS and OP may be traced back first to the stronger lengthening of nuclear and final syllables of inner (i.e., non-IP-final) intermediate phrases (ips) attested in the latter variety, second to the age of the OP speakers (see Sections 1 and 2.1), and third to vowel reduction. Both the elision of the intervocalic approximants and the ip-final lengthening can lead to higher %V, VarcoV, and VnPVI scores. For instance, when the ip-final syllables and the nuclear syllables of inner ips are excluded from the analysis of the declaratives for OP, the VarcoV and VnPVI values for both contact varieties are almost the same (VarcoV = 47.3 and VnPVI = 41.8 for OP, VarcoV = 46.1 and VnPVI = 37.3 for OS). Concerning the subjects' age, it has been shown by [21] that older speakers exhibit both a lower speech rate and higher %V scores than younger speakers. Furthermore, it is well known that vowel reduction may have a direct impact on speech rhythm, as it contributes to greater values for VarcoV and VnPVI; see, e.g., [9, 23]. Regarding OP vowel reduction, it is worth mentioning that – at least in our data – it seldom correlates with a strong durational reduction.

Both OP and OS exhibited greater %V, VarcoV, and VnPVI values than CS for the interrogatives. This is due to the IP-final lengthening found in both contact varieties. Since the lengthening is stronger in OP (see yes-no questions), this variety displayed the

highest scores. When the IP-final syllables are excluded from the counting, OP, OS, and CS show quite similar values (see Table 2).

The imperatives differ from the declaratives in presenting greater %V, VarcoV, and VnPVI values (though to a different extent), which seems to correlate with the stronger or less strong lengthening of nuclear and phrase-final syllables in the three varieties. In turn, this lengthening is maybe related to the Effort Code which usually indicates increased emphasis; see, e.g., [2, 12, 31].

The metrics capturing consonantal variability were not able to discriminate across the varieties. It should also be mentioned that the 'low' variability of C intervals for OP is due to the fact that deletion of reduced vowels, which is typical of European Portuguese and yields consonant clusters, rarely occurs in OP.

On the basis of our outcomes, it can be assumed that the prosodic systems of both contact varieties have converged in course of time, at least as durational properties are concerned: First, OS presents non-systematic reduction of unstressed vowels. Second, both varieties lengthen the IP-final syllables in interrogatives. Third, OP differs from other varieties of European Portuguese in that reduced vowels are not frequently deleted, presumably due to contact with Spanish.

Contrasts in sentence modality seem to be conveyed by durational differences in the three varieties investigated, like in other languages, see, e.g., [4, 13, 20, 30]. We found rhythmic differences between declaratives and imperatives in all three varieties (the differences being greater in OP and OS than in CS) as well as between declaratives and interrogatives in OP and OS. It thus seems to be necessary to analyze various sentence types to identify the rhythmic patterns of a certain language.

#### 5. CONCLUSION

We have shown that the two Iberian contact varieties spoken in Olivenza (Extremadura), i.e. Olivenza Portuguese and Olivenza Spanish, present similar timing patterns. The differences between the varieties studied here can be explained by considering distinct phonotactic and/or prosodic properties. The most important difference between the two contact varieties on the one hand and Castilian Spanish on the other consists in the considerable lengthening of IP-final syllables attested in the interrogatives in both Olivenza Portuguese and Olivenza Spanish. Our overall results suggest that differences in timing patterns (and hence in speech rhythm) contribute to the expression of sentence modality.

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