



On the relation between intonational phrasing and pitch accent distribution. Evidence from European Portuguese varieties

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Abstract

Intonational phrasing and pitch accent distribution (PAD) have been proposed to be interdependent (Portuguese) and independent properties of prosodic systems (Egyptian). This paper examines the relation between intonational phrasing and pitch accent distribution in two center-southern varieties of European Portuguese - Alentejo (Ale) and Algarve (Alg). Sentences obtained in a reading task systematically varied syntactic complexity (presence/absence of branching in subjects and objects) and length (in number of syllables). The results showed that (S)(VO) prevails in Ale, whereas in Alg (SVO) is preferred as in Standard European Portuguese (SEP). Unlike in SEP, both in Ale and Alg nearly every prosodic word is pitch accented, yielding a dense PAD. If in Ale intonational phrasing and PAD seem to be correlated (more phrases, dense PAD) the same does not apply in Alg (fewer phrases, but dense PAD). Our findings favor the view of phrasing and PAD as orthogonal dimensions to take into account in a description of prosodic variation within and across languages.

Index Terms: prosodic variation, intonational phrasing, pitch accent distribution, syntactic complexity, length

1. Introduction

The presence of intonational boundaries has been shown to be associated with different grammatical features, such as branchingness of a syntactic phrase, effects of focus, prosodic weight in terms of length or size of prosodic phrases, and pitch accent distribution.

Despite of the known non-isomorphism between prosodic and syntactic structures, boundaries of syntactic constituents and syntactic branching are relevant factors for the formation of prosodic constituents [1, 2, 3, 4]. Prosodic focus also plays an important role on intonational phrasing: e.g., both in Bengali [5] and Chichewa [2], the focalized constituent is followed by a prosodic boundary; in Japanese [6] as well as in dialects of Korean [7], the production of focus triggers the placement of a prosodic boundary immediately before the focalized element. Prosodic weight is another factor affecting intonational phrasing. In Standard European Portuguese (SEP), subject (S), verb (V) and object (O) are usually grouped together in a single Intonational Phrase (IP), except when S are longer than 8 syllables [8]. In Korean, the phrase length in number of syllables also constrains phrasing: when S (or O) is longer than 5 syllables, it tends to form a separated phrase [7]. Finally, pitch accent distribution and its relation with phrasing have been recently inspected [9, 10, 11, 12, 13], and two opposing views were proposed. On the basis of data from both SEP and Northern European Portuguese (NEP) a correlation between these two prosodic factors was proposed to hold within a given prosodic system (fewer phrases > fewer accents) [9]. Based on data from Cairene Arabic, an alternative proposal was put forward that sees phrasing and domain for PAD as orthogonal dimensions of a prosodic system [12].

The main goals of this paper are (i) to explore the relation between prosodic phrasing and pitch accent distribution in two center-southern varieties of European Portuguese (EP); (ii) to observe whether the correlation between these two prosodic factors described for SEP and NEP spreads or not across EP varieties; (iii) to contribute for the characterization of the relevant dimensions of variation in the intonational system, both within and across languages.

2. Intonational phrasing and pitch accent distribution in EP: SEP and NEP varieties

In previous work, intonational phrasing was compared across Romance languages (EP, Spanish, Catalan, Italian) on the basis of a common corpus adapted for each language – the *Romance Languages Database* (RLD). Initially developed within the project *Intonational Phrasing in Romance* (<http://www.fl.ul.pt/LaboratorioFonetica/intphraro.htm>), this database is now partially available online [14] and being extended to include data collected within the ongoing project *Interactive Atlas of the Prosody of Portuguese (InAPoP)* [15].

The RLD corpus [8, 16], comprises Subject-Verb-Object (SVO) sentences with varying length in number of syllables (short and long constituents) and syntactic complexity (presence/absence of branching in S and O). This corpus was designed to assess the influence of constituent length and syntactic branching on intonational phrasing. Previous work on SEP and NEP has shown that, in SEP, S, V and O are grouped into an IP (SVO), similarly to Cairene Arabic [11, 12]. In NEP, as in Catalan and Spanish [8, 17, 18], S is phrased into an IP, separately from V and O, which form another IP (S)(VO), even in non-branching conditions. It was also observed that, in SEP, the (S)(VO) phrasing pattern is triggered by length in number of syllables: subjects longer than 8 syllables may form an IP apart from the V and the O [8]. Length or branchingness of O were found not to be relevant for intonational phrasing in SEP. By contrast, in NEP, (S)(VO) is mainly triggered by branchingness: short branching S is more frequently phrased into an IP (69%) than long non-branching S (46%). Additionally, in NEP, O length also favors the (S)(VO) phrasing pattern.

Pitch accent distribution in SEP is sparse (only 17-27% of IP-internal stressed syllables bear a pitch accent), whereas NEP shows a dense pitch accent distribution with almost one pitch accent per prosodic word (74% of IP-internal stressed syllables bear a pitch accent) [9, 13].

Given the properties of intonational phrasing and pitch accent distribution in the two EP varieties, Vigário and Frota suggest that these two prosodic factors are correlated: the predominance of the (SVO) phrasing pattern in SEP is associated with a sparse pitch accent distribution (fewer phrases, fewer accents); similarly, in NEP, the preference for the (S)(VO) phrasing pattern is associated with a dense pitch accent distribution (more phrases, more accents) [13].

However, data from Cairene Arabic [11, 12] show that this hypothetical correlation proposed for EP is not a general intonational property: as in SEP, Cairene Arabic is characterized by the predominance of the (SVO) phrasing pattern but, similarly to NEP, it shows a dense PAD with one pitch accent per prosodic word.

The present research addresses the relation between intonational phrasing and pitch accentuation and examines the two alternative views: (i) the approach that sees the two prosodic factors as interdependent [9, 13]; and (ii) the approach that sees them as independent dimensions of variation within a prosodic system [11, 12].

3. Methodology

Two varieties from the Interior Center and South [19, 20] were selected from the set of urban regions covered by the *InAPoP* project: Alentejo (Ale) and Algarve (Alg). Three female speakers, aged between 20 and 45 years-old and with high-school or university level of education, were recorded in each region (3x2). The data were collected in video format (.mov), according to the procedures followed within the *InAPoP* project. Audio files were extracted from the video and saved in .wav format, 22050Hz. For each sentence, three tiers of analysis were created in *Praat* 5.2.2 [21]: the tonal tier for intonational analysis, following the Autossegmental-Metrical approach to the analysis of EP intonation [22]; the orthographic tier, which contains the orthographic transcription of the sentence aligned word by word with the spectrogram; and the phrasing tier, where break indices are annotated reflecting the prosodic structure relevant to intonation.

All speakers performed a reading task containing the RLD corpus: 76 SVO sentences, uttered twice by each speaker (76x2x6), included constituents with varying length (short = 3, 5 syllables; long = 5 to 15 syllables) and syntactic complexity (non-branching, branching and double branching). The combination of these factors yields the following conditions:

Short non-branching phrases (3 syllables)

A loura_{NP} mirava mirava morenos.
(The blond girl looked at dark-haired boys.)

Long non-branching phrases (5 syllables)

A boliviana_{NP} falava do namorado.
(The Bolivian girl talked about her boyfriend.)

Short branching phrases (5 syllables)

A nora loura_{NP+AdjP} falava do namorado.
(The blond daughter-in-law talked about her boyfriend.)

Long branching phrases (10 syllables)

O boliviano mulherengo_{NP+AdjP} memorizava uma melodia.
(The Bolivian ladies' man memorized a melody.)

Short double branching phrases (9/10 syllables)

A nora morena da velha_{NP+AdjP+PP}
(The old lady's dark-haired daughter-in-law

maravilhava meninos.
marveled boys.)

Long double branching phrases (15 syllables)

O namorado megalomano da brasileira_{NP+AdjP+PP}
(The Brazilian's girl megalomaniac boyfriend

mirava morenas.
looked at the dark-haired women.)

For the analysis, sentences produced by 2 of the 3 speakers were considered per variety, thus a total of 608 sentences (304x2) were inspected. For further details on the corpus, see [16] and [8]. Intonational phrase boundaries were determined according to both perception and acoustic-based measures.

The following boundary cues were considered: presence of a high boundary tone, pitch movement before the boundary (continuation rise, sustained pitch), pre-boundary lengthening, presence of a pause, pitch reset, and the realization of the post-stressed syllable.

4. Results

4.1. Prosodic phrasing

As in SEP and NEP [10], both Ale and Alg present a high frequency of the H% boundary tone (99% each), mainly preceded by a continuation rise. However, sustained pitch is also used in Ale and Alg, as in NEP, but with a higher frequency (32%, 34% respectively vs. 8% in NEP). Pre-boundary lengthening is also frequently perceived as a cue to phrasing in Ale (75%) and in Alg (66%), contrasting with SEP (15%), but not with NEP (72%). The comparison of duration differences (relative to the duration of the prosodic word) between sentences produced with and without an intonational break shows that the last stressed syllable of the IP is on average 6.21% longer in Ale and Alg. Contrary to SEP, where the post-stressed vowel is usually deleted, in Ale it is frequently produced (57%), similarly to NEP [10] but differently from Alg (2%). Finally, pauses are more frequent in Ale and in Alg (10%, 11% respectively) than in SEP (5%), but not as frequent as in NEP (17%).

4.1.1. Dominant phrasing pattern

In Ale, similarly to NEP [9, 13], the (S)(VO) phrasing pattern is preferred overall (66%). Even in non-branching conditions, S tends to be phrased into an IP apart from V and O (51%), as illustrated in Figure 1.

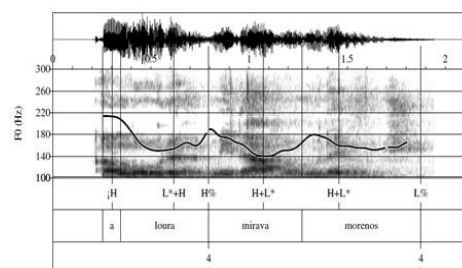


Figure 1: Dominant phrasing pattern in Ale: (S)(VO). Short non-branching S. 'A loura mirava morenos.' (The blond girl looked at dark-haired boys.)

By contrast, in Alg, and similarly to SEP, (SVO) is the dominant phrasing pattern (65%). Furthermore, the preference for (SVO) is stronger in non-branching conditions (85%) (see Figure 2).

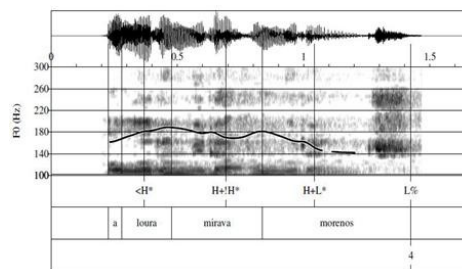


Figure 2: Dominant phrasing pattern in Alg: (SVO). Short non-branching S. 'A loura mirava morenos.' (The blond girl looked at dark-haired boys.)

In sum, the two Interior Center and Southern varieties show different dominant phrasing patterns overall (without considering the effects of constituent length and syntactic complexity): Ale is more similar to the Northern variety, whereas Alg is closer to the Standard variety. Both speakers from each variety present similar results (speakers from Ale produce less than 50% of (SVO) sentences, while speakers from Alg produce higher percentages of (SVO) sentences (62%, 67%). These results lead to the conclusion that varieties previously classified as being distinct, on the basis of phonological segmental variation [19, 20, 23, *inter alia*], may share similar prosodic characteristics (NEP and Ale); and regions belonging to the same variety (Interior Center and South), on the basis of phonological segmental variation, may display different prosodic characteristics (Ale and Alg).

4.1.2. Triggering (S)(VO) phrasing: the effect of syntactic complexity

To examine the effect of syntactic branching as a potential trigger of the (S)(VO) phrasing pattern, conditions with identical length but different complexity were analyzed. As shown in Table 1, in Ale, as in Alg, short branching S are mostly phrased into a single IP, unlike long non-branching S.

Table 1. Role of syntactic branching in the (S)(VO) phrasing pattern – Ale and Alg.

	Ale	Alg
Long non-branching S	63%	25%
Short branching S	94%	72%

Although syntactic branching triggers the phrasing of S into a single IP in both varieties, it clearly plays a more relevant role in Alg than in Ale. In Alg, non-branching S phrase together with V and O and only branching S tend to be phrased into a single IP (Figure 2 vs. Figure 3).

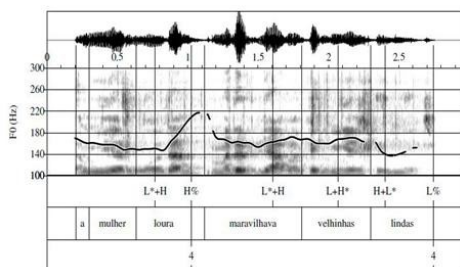


Figure 3: Alg – (S)(VO) in sentences with short branching S. 'A mulher loura maravilhava velhinhas lindas.' (The blond woman marveled beautiful old ladies.).

By contrast, in Ale, (S)(VO) phrasing of non-branching S is a common pattern (Figure 4).

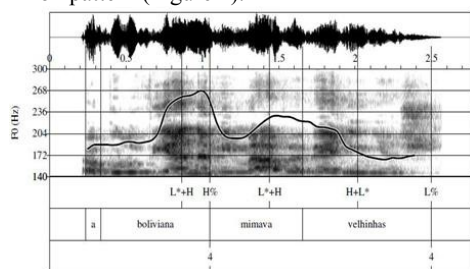


Figure 4: Ale – (S)(VO) in sentences with long non-branching S. 'A boliviana mimava velhinhas.' (The Bolivian girl spoiled old ladies.).

The comparison of these data with previous results for NEP and SEP (Table 2) shows that both in Ale and in Alg, similarly to NEP, syntactic branching constrains prosodic phrasing, although with varying degrees: in NEP, as in Ale, the percentage of non-branching S phrased into an IP is higher than 50%; however, in NEP, the increase of (S)(VO) phrasing occurrences from non-branching to branching S is not as expressive as in Ale (13% vs. 31%).

Table 2. Role of syntactic branching in the (S)(VO) phrasing pattern – NEP and SEP [11].

	NEP	SEP
Long non-branching S	56%	4%
Short branching S	69%	4%

In contrast with both the Northern and the Interior Center and Southern varieties, in SEP, syntactic branching has no effect on (S)(VO) phrasing. This phrasing pattern in the Standard variety is only triggered by length in number of syllables.

4.1.3. Triggering (S)(VO) phrasing: the effect of length

Besides syntactic branching, length in number of syllables also triggers the (S)(VO) phrasing pattern in Ale (Table 3): the dominant pattern in long non-branching S is (S)(VO) (63%), whereas in short non-branching S (SVO) prevails. In Alg, by contrast, length plays a reduced role compared to syntactic branching: (S)(VO) becomes the dominant pattern only in branching conditions.

Table 3. Role of length (in number of syllables) in the (S)(VO) phrasing pattern – Ale and Alg.

	Ale	Alg
Short non-branching S	38%	6%
Long non-branching S	63%	25%
Short branching S	94%	72%
Long branching S	95%	89%

In sum, in Ale, length in number of syllables together with syntactic branching trigger the (S)(VO) phrasing pattern, whereas in Alg syntactic branching is the relevant factor. Differently from the Interior Center and Southern varieties, in SEP length plays a major role in the (S)(VO) intonational phrasing: S with more than 8 syllables tend to form a single IP [8].

4.2. Pitch accent distribution: is it correlated with intonational phrasing?

The analysis of pitch accent distribution and intonational phrasing in NEP and SEP led to the proposal of a correlation between these two prosodic factors [9, 13]. As shown in Table 4, a dense pitch accent distribution in NEP co-occurs with a preference for the (S)(VO) phrasing pattern, whereas in SEP (as illustrated in Figure 5), a sparse pitch accent distribution is associated with the predominance of (SVO).

Table 4. Intonational phrasing and tonal density in NEP and SEP [9, 13].

Variety	Dominant phrasing pattern	Tonal density
NEP	(S)(VO)	74%
SEP	(SVO)	17-27%

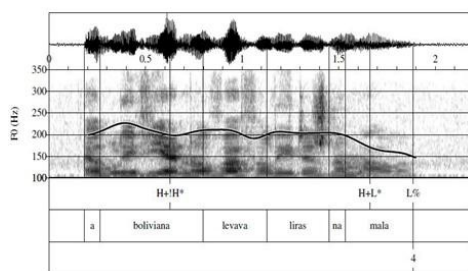


Figure 5: *SEP* – Sparse pitch accent distribution and (SVO) phrasing. ‘A boliviana levava liras na mala.’ (The Bolivian girl took liras in her purse.).

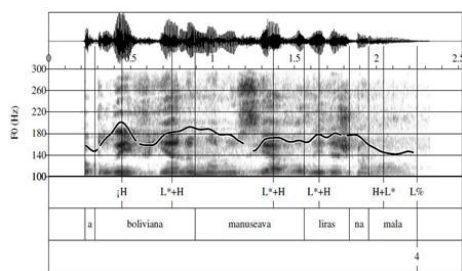


Figure 7: *Alg* – Dense pitch accent distribution, but (SVO) phrasing. Long non-branching S: ‘A boliviana manuseava liras na mala.’ (The Bolivian girl handled liras in her purse.).

In the present research we examine if the suggested correlation spreads or not to other varieties of EP. Based on the dominant phrasing patterns in Ale and Alg, discussed above (section 4.1.1), and assuming the hypothesis that the two prosodic factors are inter-related, the following results would be expected: (i) a dense pitch accent distribution in Ale, since this variety is characterized by a preference for the (S)(VO) phrasing pattern (similarly to NEP); and (ii) a sparse pitch accent distribution in Alg, given the predominance of the (SVO) phrasing pattern (similarly to SEP).

Previous accounts of tonal density in the Interior Center and Southern varieties [24, 25] have shown that both Ale and Alg, similarly to NEP but in contrast with SEP, are characterized by a dense pitch accent distribution: 100% of IP-internal stressed syllables bear a pitch accent in Ale, and 87% of IP-internal prosodic words are pitch accented in Alg (Table 5).

Table 5. *Intonational phrasing and tonal density in Ale and Alg. Data on tonal density from [24, 25, 26].*

Variety	Dominant phrasing pattern	Tonal density
Ale	(S)(VO)	100%
Alg	(SVO)	87%

Consequently, phrasing pattern and tonal density seem to be correlated in Ale (Figure 6), as suggested for NEP and SEP, but not in Alg (Figure 7).

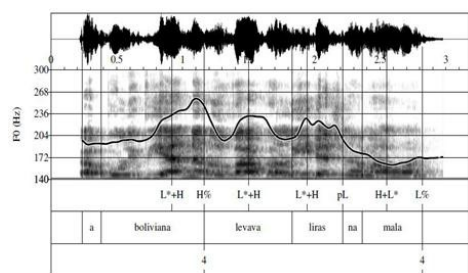


Figure 6: *Ale* – Dense pitch accent distribution and (S)(VO) phrasing. Long non-branching S: ‘A boliviana levava liras na mala.’ (The Bolivian girl took liras in her purse.).

In sum, in Alg, and similarly to Cairene Arabic [11, 12], there is a predominance of (SVO) together with a dense pitch accent distribution, which leads to the conclusion that the suggested interdependence between these two prosodic factors does not spread across all varieties of EP and is therefore not a general property of the prosodic system of the language.

5. Conclusions

The findings on intonational phrasing patterns and pitch accent distribution in two varieties from the Interior Center and South of EP (Ale and Alg) provide interesting data for our understanding of the relevant dimensions of prosodic variation within and across languages.

Firstly, it was found that in Ale, as is NEP, there is a preference for the (S)(VO) pattern, contrasting with the predominance of (SVO) in Alg, as in SEP. These results show that varieties reported to be identical on the basis of their segmental phonetics and phonology do not necessarily share the same prosodic properties. Besides contributing to the characterization of the prosodic system of EP, this finding strengthens the need to map within-language prosodic variation (as it has been done within the *InAPoP* Project).

Secondly, both syntactic complexity and length (in number of syllables) were found to constrain intonational phrasing although with varying degrees across varieties. In Ale, as in NEP, (S)(VO) is favored by syntactic branching and length. However, syntactic branching is the most relevant factor in NEP, whereas length plays the most important role in Ale. In Alg, syntactic branching is the trigger of (S)(VO). In SEP, length is the crucial factor behind (S)(VO) intonational phrasing.

Thirdly, it was observed that both Ale and Alg, similarly to NEP, present a dense pitch accent distribution, contrary to SEP that is characterized by a sparse pitch accent distribution. Thus the interdependence between phrasing and PAD (fewer phrases, fewer accents; more phrases, more accents) that holds in SEP, NEP, and Ale was not found in Alg. These results concur to the hypothesis that the two factors are independent properties of prosodic systems.

Finally, our findings clearly show that (i) both intonational phrasing and tonal density are important factors for the characterization of the intonational system, and that (ii) the two dimensions may vary independently across languages and across language varieties.

6. Acknowledgements

This research was supported by the PhD grant BD/61463/2009 and by the project grant *InAPoP* – *Interactive Atlas of the Prosody of Portuguese* (PTDC/CLE-LIN/119787/2010), both funded by Fundação para a Ciência e a Tecnologia, Portugal. We also thank all the speakers involved in the data collection tasks.

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