# The intonational phonology of European Portuguese

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## 1. Introduction

This chapter provides an analysis of the prosodic and intonational structure of European Portuguese. The framework adopted is the auto-segmental metrical theory of intonational phonology, according to which intonation has a phonological organisation, and intonational features relate with independent features of the phonological organisation of speech established on the basis of prosodic structure (Beckman & Pierrehumbert 1986, Hayes & Lahiri 1991a, Grice 1995, Jun 1996, Ladd 1996, Gussenhoven 2004, among many others). The linguistic variety analysed is Standard European Portuguese (henceforth EP) as spoken in Lisbon, and other varieties of Portuguese are only briefly mentioned. The analysis has been developed on the basis of corpora especially collected for this purpose, which mainly consist of read speech materials uttered under laboratory conditions.

The structure of this chapter is as follows. Section 2 provides an overview of previous work on EP prosody. Section 3 is devoted to our analysis of prosodic phrasing and intonation, focusing on prosodic structure and its interaction with intonation, as well as on the account of the intonational features of the main sentence types and the prosodic reflexes of focus. Section 4 describes briefly some critical differences in phrasing and intonation patterns across varieties of Portuguese. Finally, section 5 summarizes the principal findings and highlights a few challenges for future research.

## 2. Previous work on EP prosody

In earlier work on EP prosody, there is much disagreement on the definition of prosodic constituents, on the definition of intonation, the linguistic status of intonational phenomena, and the ways these phenomena are examined (see Frota 2000: sections 1.5-1.6 for an overview). Viana (1987) is the first work on the intonation of EP that combines the goal of providing a phonological description with the goal of presenting phonetic evidence for the intonational categories proposed. After this pioneering work, during the 90s authors have

concentrated mostly on the description of declarative intonation (Frota 1993, 2000, Falé 1995, Vigário 1997, 1998, Frota & Vigário 2000). Specific work addressing crucial issues to intonational phonology analyses, such as the typology of pitch accents and edge tones assumed to account for a given contour, and the details of association and alignment of tonal events with the segmental string, as well as the details of scaling, has only emerged in the last decade (Frota 1997b, 2000, 2002a,b, 2003, Grønnum & Viana 1999, Frota et al 2007). Similarly, the extension of the analysis to other sentence types, namely question intonation, and to different varieties of Portuguese is fairly recent (Frota 2002b, Frota & Vigário 2000, 2007, Tenani 2002, Vigário & Frota 2003, Fernandes 2007).

Work on the prosodic structure of EP where segmental, durational and intonational evidence for phrasing are discussed has appeared in the 90s (Frota 1993, 1996, Ellison & Viana 1996, Vigário 1997, 1998). A thorough description of prosodic phrasing above the word level, including the effects of focus, is found in Frota (2000, 2002c). An account of the prosodic word and the phrasing between the word and the phonological phrase is provided in Vigário (2003). More recently, the interaction between syntactic and prosodic factors and the patterns of intonational phrasing has also been inspected (Elordieta, Frota & Vigário 2005, Frota & Vigário 2007).

In the following sections of the present chapter, the key findings of previous work are described where relevant, as well as the main points of agreement and/or dispute across studies.

## 3. Prosodic Phrasing and Intonation in EP

EP has a prosodic system that deviates in some important aspects from the 'typical' prosody of Romance languages (such as Italian or Spanish), both with respect to prosodic structure and intonation. Section 3.2 examines the prosodic structure of EP, the (non-)effect of focus on prosodic phrasing, and the relation between phrasing domains and the assignment and

distribution of pitch accents. Section 3.3 proposes an account of the intonation of the main sentence types, including neutral renditions and the expression of focus. Firstly, in section 3.1 the data and data collection procedure are described.

### 3.1. Data and methodological procedures

The analysis presented here has been developed on the basis of several corpora of spoken EP especially collected for this purpose, including data from 7 different speakers. Over 3500 utterances have been inspected, both auditorily and acoustically (by means of wideband spectrograms, spectral analysis, and Fo contours – see Frota 2000, 2002a, 2003, Frota & Vigário 2007, for a full description of the analysis procedures). The corpora consist of read speech materials collected under laboratory conditions and designed to specifically address issues of segmental realization (as in the case of sandhi phenomena constrained by prosodic domains), of duration contrasts (as in the case of boundary-induced lengthening), and of intonational phenomena (as in the case of alignment of tonal events relative to heads and edges of prosodic phrases). Both neutral renditions and renditions in which a particular constituent is focalised, and thus a broad focus reading is lost in favour of a narrow/contrastive focus reading, were obtained: the former have been elicited as out-of-the-blue utterances or all-new utterances triggered by context; the latter have been uttered in response to an eliciting context that triggered the focus. The focus eliciting contexts have been previously assessed by an independent group of subjects, and the focus utterances obtained have been judged as conveying the intended meaning by a different group of listeners (for a full description of the general data collection procedure, see Frota 2000). Utterances pertaining to the various sentences types, such as yes-no questions, imperatives, or the vocative chant have also been obtained by means of eliciting contexts and judged by independent listeners to be naturally sounding.

### 3.2. Prosodic Structure

In the analysis adopted here, an integrated view of prosodic structure is assumed in the sense that the same hierarchical structure defines the domains of external sandhi, of final lengthening, and the domains relevant for intonation. Evidence strongly suggests that such is the case in EP (Frota 2000), similarly to reports for other languages (Hayes & Lahiri 1991a, Hellmuth 2007). Thus, intonational phenomena are just one of the possible ways in which the prosodic hierarchy manifests itself. EP has three prosodic constituents at and above the word level: the prosodic word, the phonological phrase and the intonational phrase. Evidence in support of these three prosodic constituents is described below.

**3.2.1. The prosodic word**

The prosodic word (henceforth PW) consists of a stem plus suffixes. Clitics (that is, stressless items) are incorporated into the host PW when enclitics, and proclitics as well as prefixes are adjoined to the following PW. Prosodic words in EP may contain from one up to more than three syllables (even if clitics are excluded), and monosyllabic words with open syllables are also present in the lexicon (Frota, Vigário & Martins 2006). Evidence for the PW comprises edge-related phenomena – signalling both the left and the right edges of PW –, word-bound phenomena – phenomena that select the PW as their domain, such as clipping and deletion under identity –, and prominence-related phenomena. These phenomena are illustrated in (1) to (5) below. The full set of tests available as diagnostics for the PW is described in Vigário (2003).

(1) Phonotactic constraints at the left-edge

*rato* [ˈʁa.tu] / *[ˈɾa.tu] vs. *caro* [ˈka.ɾu] ‘mouse’/’car’

**erguer* *[ɨɾ.ˈgeɾ] vs. *perder* [pɨɾ.ˈdeɾ] ‘to raise’/to loose’

(2) Non-raising of PW-initial stressless vowels

*erguer* [eɾ.ˈgeɾ] vs. *roedor* [ɾu.ɨ.ˈdoɾ] ‘raise’/’rodent’

*opinião* [o.pi.ni.ˈɐ̃w̃] vs. *miolinho* [mi.u.ˈli.ɲu] ‘opinion’/ ‘soft part of bread-DIM’

(3) Deletion of PW-final non-high palatal vowels

*passe* [ˈpas] vs. *passemos* [pɐˈsemuʃ]/ *passear* [pɐˈsjaɾ]

‘to pass / pass-SUBJ-2pp, take a walk’

(4) Clipping as PW-deletion

| | | | |
|---|---|---|---|
| ~~*tele*~~*móvel* > *móvel* | (tele)$_{PW}$(móvel)$_{PW}$ > móvel | [ˈtɛlɛ ˈmɔvɛɬ] | ‘mobile’ |
| *telefonia* > **fonia* | (telefonia)$_{PW}$ > *fonia | [tɨlɨfuˈniɐ] | ‘radio’ |

A PW has only one stress, and thus every element bearing a morphologically/lexically assigned stress forms a PW on its own. PW stress is perceptually salient in EP, not only because the stressed syllable is signalled by longer duration, but also because there are many segmental processes that refer to the presence/absence of stress. One of such processes is phonological vowel reduction, namely centralization and raising of unstressed vowels, as shown in (5).

(5) Vowel reduction of unstressed vowels

*dá* [ˈda] vs. *dada* [ˈdadɐ] / *da* [dɐ] ‘to give / given-FEM, of-the-FEM’

*dê* [ˈde] vs. *de* [dɨ] ‘to give-SUBJ-3PSING / of’

Since a PW has only one stress, it may only bear one pitch accent (in EP, unlike in Brazilian Portuguese or Greek, only the lexically stressed syllable within the PW may be pitch accented – Frota & Vigário 2000, Tenani 2002, Arvaniti & Baltazani 2005). However, a PW does not need to be pitch accented in EP, and in fact most PWs in prenuclear or post-nuclear position are not accented (see 3.2.5 below). The first PW of the intonational phrase is the domain of realization of the (optional) phrasal tone H, which is associated to the left-edge of this phrase (see 3.2.3 below, and Frota 2003).

The clustering of numerous phenomena signalling the PW in EP, as described above, is an important property of the language that makes it closer to Germanic than to other Romance languages (Vigário 2003, Vigário, Freitas & Frota 2006).

### 3.2.2. Phonological phrase

Like in many other languages, phonological phrase formation in EP applies within the maximal projection of a lexical head ($Lex^{max}$). A phonological phrase (PhP) in EP includes the lexical head, the elements on the head's nonrecursive side within $Lex^{max}$, and a following nonbranching phrase also within the $Lex^{max}$ domain. The inclusion of the latter reflects the presence of a weight condition on PhPs: if possible, a PhP should contain more material then a PW (Frota 2000). By default, prominence within the PhP is rightmost, that is the final PW is the PhP-head. Evidence for this level of phrasing in EP comes from three sources, as illustrated in (6) to (8) below: (i) the PhP bounds the operation of stress strengthening (a stress clash resolution process by lengthening of the first clashing syllable); (ii) it plays a crucial role in the definition of rhythmic constraints on the output of vowel sandhi (namely, vowel deletion is not allowed if the words involved are the heads of PhPs); and (iii) it accounts for the attested patterns of pitch accent distribution in prenuclear position (in particular, if a PW is pitch-accented within a PhP this PW is the head of the phrase, and no PW may be accented if the head is not accented as well – Frota 2000, 2003).

(6) Stress strengthening

(stressed syllables in capitals; lengthening of the 1st stressed syllable signaled by underlying; see Frota 2000: Chap.3 for the quantitative data analysis)

a. [ o caFÉ ]$_{PhP}$ LUta pelo prémio do produto mais qualificado

[ o caFÉ ]$_{PhP}$ luTOU pelo prémio do produto mais qualificado

'the coffee disputes / disputed the award of the best product'

b. [ o caFÉ LUso ]$_{PhP}$ contém cevada de boa qualidade

[ o caFÉ lusiTAno ]$_{PhP}$ contém grãos de várias qualidades

'the Lusitanian coffee contains barley of good quality / grains of various qualities'

(7) Rhythmic constraints on vowel sandhi

(vowels affected underlined; stressed syllables in capitals; head of PhP in bold)

a. [ o dançaRIno ]$_{PhP}$ [ **A**ma ]$_{PhP}$ [ a bailarina russa ]$_{PhP}$ *dançarinama

'the dancer loves the Russian ballerina'

b. [ o bailaRIno ]$_{PhP}$ [ ANda **SEMpre** ]$_{PhP}$ [ de limusine preta ]$_{PhP}$ $^{ok}$bailarinanda

'the dancer always drives a black limousine'

(8) Patterns of pitch accent distribution (PhP head in bold)

[ a LÂmina **LONga** ]$_{PhP}$ é mais eficaz 'a long blade is more efficient'

| | |
|---|---|
| No | Yes |
| Yes | Yes |
| *Yes | No |

Unlike in many languages, however, the PhP in EP is not the domain of any sandhi rule, does not exhibit temporal boundary marking (namely, there is no PhP-final lengthening distinguishing the PW-level from the PhP-level – see Frota 2000: Chap.4), and does not have to be tonally marked. PhP-edges are not signalled by edge-tones in EP, and PhPs need not be pitch accented (Vigário 1998, Frota 2000, 2002a,b; see also 3.2.5 below). The PhP-level has therefore subtle manifestations in the prosody of EP when compared to languages such as English, Italian, Greek, or Bengali (Nespor & Vogel 2007, Ghini 1993, Grice 1995, Arvaniti 1994, Hayes & Lahiri 1991a).

### 3.2.3. Intonational phrase

The intonational phrase (IP) groups all adjacent PhPs within a root sentence; PhPs in a string not structurally attached to the sentence tree form an independent IP on their own (e.g. parenthetical phrases, explicative phrases/clauses, tags, vocatives, topics). IPs are constrained

by weight conditions: long phrases tend to be divided, balanced phrases or the longest phrase in the rightmost position are preferred. Importantly, short IPs are not demoted to PhPs but they may form a Compound IP-domain with an adjacent IP (Frota 2000). The length conditions that trigger the division of long phrases into several IPs operate from left to right, thus resulting in the (S)(VO) phrasing of SVO utterances when the subject is more than eight syllables long (Elordieta, Frota & Vigário 2005). The same kind of constraint seems to promote compound IPs, as in all the data reported in Frota (2000) the short IPs involved in compound phrasing crucially contain less than 8 syllables.[1] Prominence within the IP is rightmost, by default, that is the head of the final PhP gets IP-level prominence.

There is abundant evidence for this level of phrasing in EP. The IP bounds the application of many sandhi rules (such as Syllable Degemination, Vowel Merger, Vowel Deletion, Semivocalization, and Fricative Voicing – see Frota 2000: Chap.2, and Vigário 2003: Chap.3; see also (9-10) below), it is the domain for pre-boundary lengthening, it defines the locus for pauses, and it has a precise intonational definition: the intonational phrase is the domain of the minimal tune in EP, as only the IP-head must be pitch-accented (see also 3.2.5 below) and only the right-edge of the IP requires tonal boundary marking in the language. Further, the left-edge of the IP is optionally signalled by %H or by a phrasal H tone associated to this edge and realized within the domain of the first PW (for a detailed analysis of IP-initial peaks, see Frota 2003; an example of left-edge tonal marking is given in section 3.3.1, Fig. 4). Another property of the IP left-edge is the strong tendency of proclitic words to appear realized in their non-reduced forms when IP-initial, as shown in (10) below (Frota 2000:251-253; Vigário 2003: Chap.7).

[1] Weight conditions on compound IPs, however, require further investigation, as the data in Frota (2000), unlike in Elordieta et al (2005), did not distinguish between number of syllables, number of prosodic words and number of phonological phrases.

The examples in (9)-(10) illustrate the patterns of intonational phrasing in EP described above. Evidence for phrasing comes from Fricative Voicing (a word-final fricative followed by a word-initial vowel is realized as [z] within the IP versus [ʃ] at the juncture), presence/absence of pre-boundary lengthening (indicated by underlying) as well as of a boundary tone at the right-edge, and non-reduced/strong form realization of IP-initial clitics. As shown in (9b/c) or (9d/e), compound phrasing of IPs may obtain if a short IP is involved, in which case Fricative Voicing applies throughout any of the IPs and all the IP right-edges are marked by lengthening as well as by the presence of a boundary tone (see Figure 1). The inner IP right-edge is different from the outer IP edge simply due to the degree of final lengthening (signaled by double underline for the stronger boundary) and the magnitude of pitch range in the boundary rise (illustrated in Figure 1). In (10), the independent IP-phrasing of a topic phrase, whether dislocated (10b) or in situ (10c), is shown by Fricative Voicing and percentage of realization of the clitic word *aos* 'to-the' in its strong form [awʃ] or reduced form [ɔʃ] (data from Frota 2000; see also section 3.3.1, Fig. 5, for the intonation contour of example (10c) ).

(9) a. [ a[z] aluna[z] obtiveram boa[z] avaliaçõe[ʃ] ]$_{IP}$

'the students have got good marks'

b. [ a[z] aluna[ʃ] ]$_{IP}$ [ até onde sabemo[ʃ] ]$_{IP}$ [ obtiveram boa[z] avaliaçõe[ʃ] ]$_{IP}$

'the students, as far as we know, have got good marks'

c. [[ a[z] aluna[z] ]$_{IP}$ [ até onde sabemo[ʃ] ]$_{IP}$ ]$_{IP}$ [obtiveram boa[z] avaliaçõe[ʃ] ]$_{IP}$

d. [a[z] aluna[z] estrangeiras no[z] Açore[ʃ] ]$_{IP}$ [até onde sabemo[ʃ] ]$_{IP}$

[aceitaram vir]$_{IP}$

'the foreign students in Azores, as far as we know, have agreed to come'

e. [a[z] aluna[z] estrangeiras no[z] Açore[ʃ] ]$_{IP}$ [ [até onde sabemo[z] ]$_{IP}$

[aceitaram <u>vir</u>]$_{IP}$ ]$_{IP}$

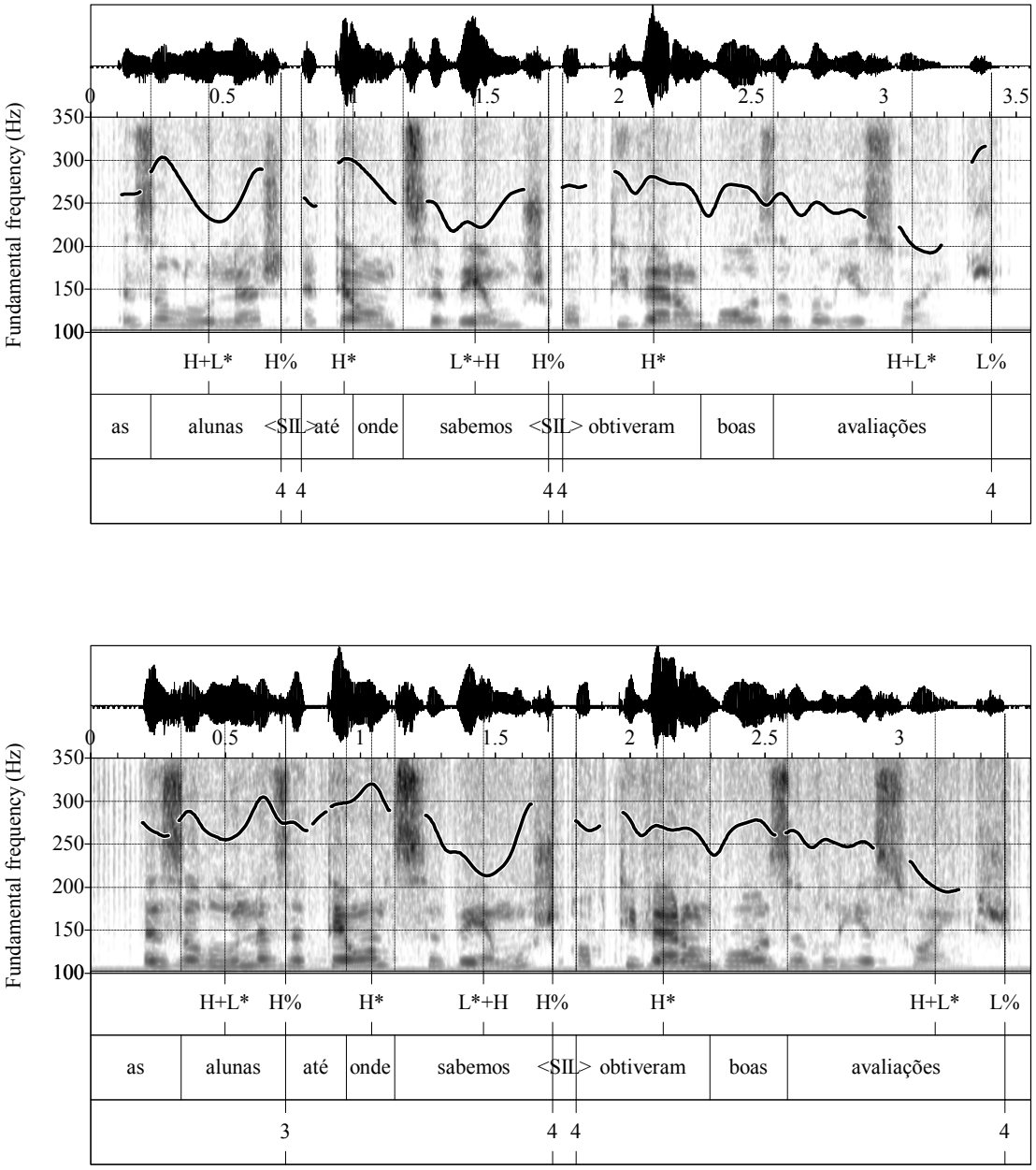



Figure 1. F0 contours of the utterances in (9b) – top panel – and (9c) – bottom panel. Here and in all the other examples the label tiers indicate, respectively, the tonal analysis, the orthographic transcription of the words spoken, and phrase boundary strength information (where 3 marks the edge of an inner IP within a compound IP and 4 the edge of an outer IP).

(10) a. [ a[z] angolana[z] ofereceram especiaria[z] [ɔʃ] jornalista[ʃ] ]$_{IP}$

‘the Angolan women offered spices to the journalists’ (80%)

b. [ [awʃ] jornalista[ʃ] ]$_{IP}$ [ a[z] angolana[z] ofereceram especiaria[ʃ] ]$_{IP}$

‘to the journalists, the Angolan women offered spices’ (88%)

c. [ a[z] angolana[z] ofereceram especiaria[ʃ] ]$_{IP}$ [ [awʃ] jornalista[ʃ] ]$_{IP}$

‘the Angolan women offered spices, to the journalists’ (92%)

It should be noted that if the properties of the PW and the PhP set EP apart from Romance languages, the same cannot be said about the IP as far as the segmental facts are concerned: in EP, like in other Romance languages but unlike in Germanic languages, the IP is the domain for resyllabification (Pepperkamp 1997, Vigário 2003, Nespor & Vogel 2007).

### 3.2.4. Focus and prosodic phrasing

In EP, the prosodic phrasing patterns described in the previous sections do not change under narrow or contrastive focus (Frota 2000, 2002c). Utterances obtained as answers to wh-questions, or elicited by means of contexts that trigger contrastive focus interpretation (see 3.1 above) show the exact same phrasing as neutral (broad focus) utterances.

At the phonological phrase level, the stress strengthening facts described in section 3.2.2 above (and illustrated by the examples in (6) ) also hold under focus, showing that the distinction between within and across PhPs is maintained: for example, in (11) below ‘fé’ but not ‘lã’ lengthens with respect to its focalized counterpart in a non-clashing sequence.

(11) Stress strengthening under Focus

(stressed syllables in capitals; Focus in bold; lengthening of the 1st stressed syllable signaled by underlying; see Frota 2000: Chap.3 for the quantitative data analysis)

a. [ o **ca<u>FÉ</u>** LUso ]$_{PhP}$

[ o **caFÉ** lusiTAno ]$_{PhP}$ ‘Lusitanian coffee’

b. [ O **gaLÃ** ]$_{PhP}$ ANda de porsche ‘the hero drives a Porsche’

[ O **gaLÃ** ]$_{PhP}$ anDAva de porsche ‘the hero used to drive a Porsche’

In addition, the pitch contour of the fall associated with the focused word (to be fully described in section 3.3) remains constantly aligned with respect to the stressed syllable regardless of the number of either pretonic or post-tonic syllables and the number of syllables from a previous or until a following PhP boundary (Frota 2002a). These facts also argue in favour of the absence of a new tonal boundary before or after focus.

At the intonational phrase level, focus was found not to affect the application of any of the sandhi rules that span the IP domain. This is illustrated in (12) by Fricative Voicing, that is not blocked either before or after focus (but is blocked in the case of topics, as shown in (10) above; in (12) boldface signals focus). Further, the percentage of realization of the clitic *aos* 'to-the' in its weak form also shows the absence of an IP-boundary before focus in (12b), contrasting with the IP-boundary before the topic in (10c).

(12) a. [ **a[z] angolana[z]** ofereceram especiaria[z] aos jornalista[ʃ] ]$_{IP}$

'(It were the) the Angolan women (that) offered spices to the journalists'

b. [ a[z] angolana[z] ofereceram especiaria[z] **[ɔʃ] jornalista[ʃ]** ]$_{IP}$

'the Angolan women offered spices TO THE JOURNALISTS' (88%)

The identity in intonational phrasing between focus and neutral utterances against utterances with a topic is further supported by tonal facts: (i) the pitch falls to the bottom of the speaker´s range either before or after a topic, but not before or after a focus; (ii) there is always a pitch rise (or reset) after a topic, but never after a focus (examples are provided in Figs. 5 and 7 in section 3.3 below).

### 3.2.5. Phrasing domains and pitch accents

One of the distinguishing prosodic features of EP, in particular among Romance languages, is the sparseness of pitch accents within the IP. This is a result of two conjoined facts: length of prosodic phrases and pitch accent distribution.

As already mentioned, intonational phrases in EP are mapped from root sentences, and thus it is rather common that subjects, verbs and objects (even sentential ones) are joined together in the same IP. While very long subjects tend to form an IP on their own, the same does not happen to very long objects that tend to phrase with the verb (Elordieta, Frota & Vigário 2005). Therefore, an IP may consist of more than 9 PWs, and in a corpus of utterances with the average length of 5.2 PWs, 54.4% of the IPs produced have 4 or more PWs (the numbers are based on the data in Elordieta et al 2005 and Frota & Vigário 2007).

Only an IP-head, as noted above, must be pitch-accented in EP. Prosodic words need not be so, as well as heads of PhPs also do not require a pitch accent. Indeed, only 17% of IP-internal stressed syllables were pitch accented in a corpus of utterances with 3 to 8 prosodic words (Vigário & Frota 2003). In Hellmuth's (2007) terms, the relevant domain for pitch accent distribution in (Standard) EP is the intonational phrase. This, together with IP-length, accounts for the sparse distribution of pitch accents in the language. Other varieties of Portuguese may show a richer pitch accent distribution, similar to other Romance languages, either because intonational phrases are smaller and/or the relevant domain for pitch accent distribution is smaller (the PhP or even the PW). I will go back to this point in section 4.

### 3.3. Intonational analysis

For the intonational analysis of European Portuguese, we recognize two types of tonal events: pitch accents, which associate to stressed syllables, and edge tones, which show a peripheral association to intonational phrase edges. In EP, there is no evidence for phrase accents, nor to another prosodic phrase, besides the intonational phrase, whose edges are tonally marked.[2]

[2] It is important to recall that IP-edges are not only the only ones to be tonally marked, but they are also the only ones signalled by final lengthening. In the particular circumstances where compound IP-phrasing obtains (see section 3.2.3), the properties that define IP-edges are present in both the inner and outer edges of the IPs, but manifest themselves with different strength. Thus the difference between an inner IP and an outer IP is a gradient one, whereas the distinction between an IP and a PhP involves a contrast in type, that is a different prosodic category.

The tonal events of the language behave as morphemes that encode semantic/pragmatic information, whether in isolation or in combination in a given tune. In the next sections, the intonation of the main sentence types is described, as well as the interaction between prominence, intonation and focus.

### 3.3.1. Declaratives

All known descriptions of declarative intonation in EP (Viana 1987; Vigário 1998; Grønnum & Viana 1999; Frota 2000, 2002a, 2002b, inter alia) characterise the declarative contour as consisting of an initial rise and a final fall. In work on EP intonation couched within the autosegmental-metrical theory, the initial peak has been shown to pertain either to an accentual tone associated to the first stressed syllable (usually H* or L*+H), to an initial boundary tone (%H), or to a phrase initial H tone with a secondary association to the first PW (Frota 2003). The final fall has been described as containing an accentual Low target immediately preceded by a peak (H+L*), and followed by a Low boundary tone (e.g. Frota 2002a; Vigário & Frota 2003). The accentual fall occurs in the last stressed syllable of the IP, that is the IP-head. As described in section 3.2.5 above, the stretch of the contour between the initial peak and the nuclear fall is usually accentless, thus showing a plateau-like shape. The sparseness of tonal events IP-internally, the initial accentual peak and the nuclear fall that characterize neutral declaratives are illustrated in Figures 2 and 3. Figure 4 provides an example of the phrase initial H tone, which is always realized within the domain of the first prosodic word and usually on the second or third syllables irrespective of stress.

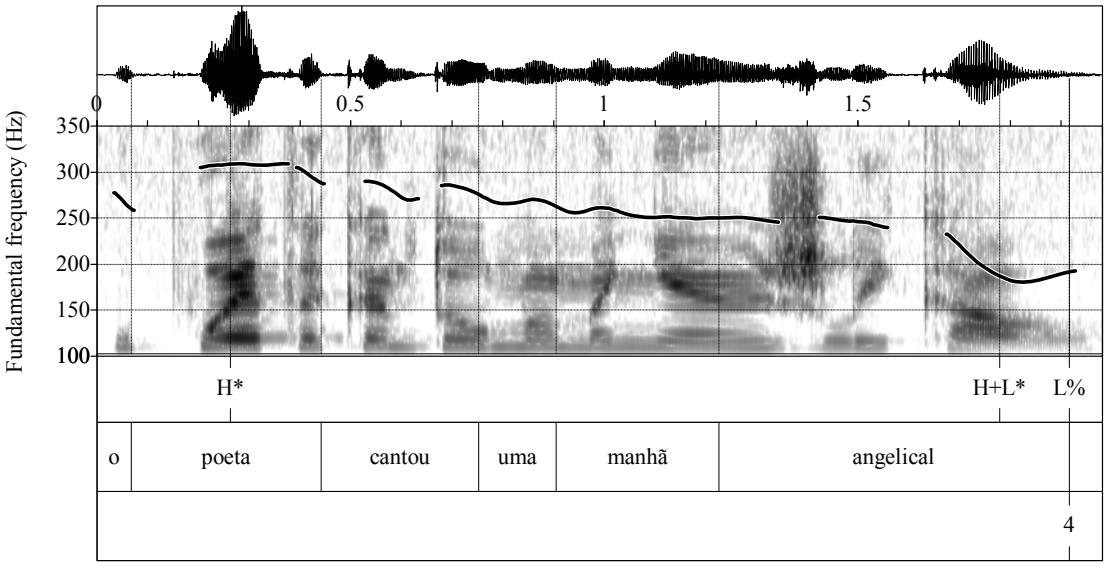



Figure 2. Fo contour of the utterance 'o POEta canTOU uma maNHÃ angeliCAL' (*the poet sang an angelic morning*), produced as a neutral declarative. Here and elsewhere in the example sentences capital letters indicate word stressed syllables.

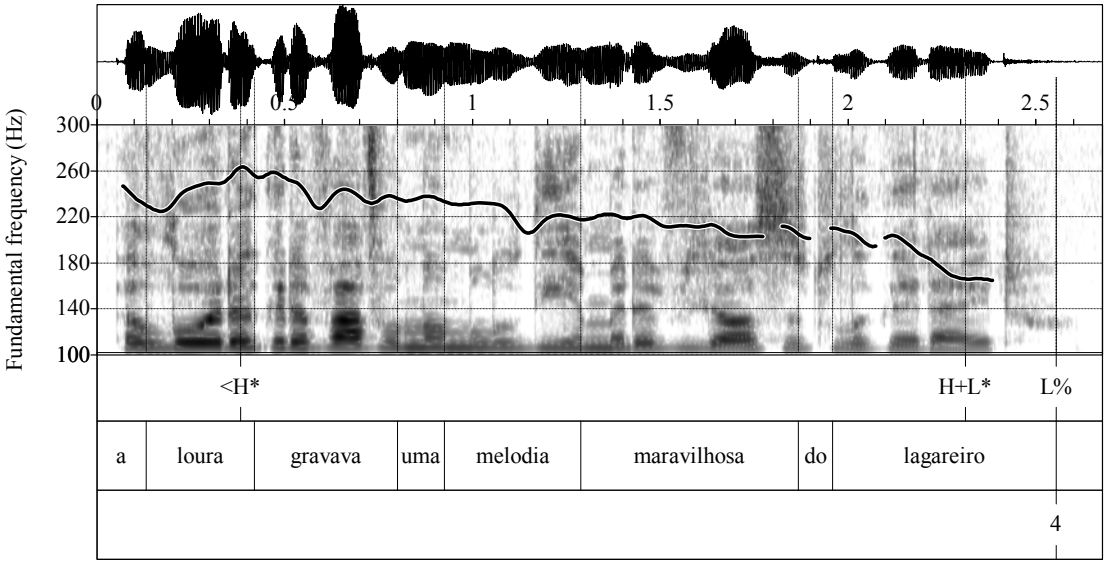



Figure 3. Fo contour of the utterance 'a LOUra graVAva uma meloDIa maraviLHOsa do lagaREIro (*the blond girl recorded a wonderful song from the olive-pressman*), produced as a neutral declarative.

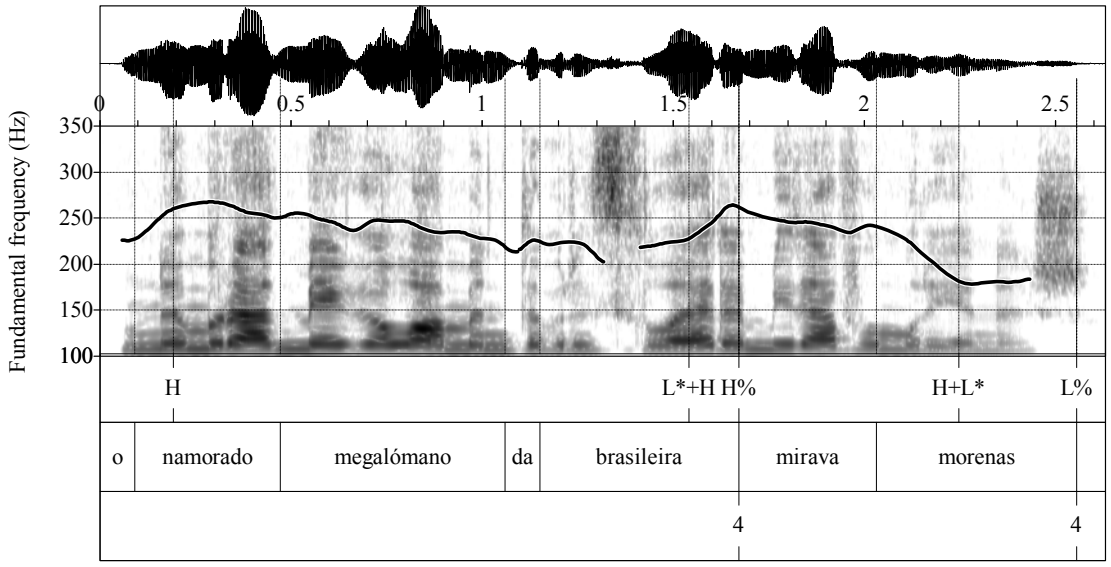



Figure 4. Fo contour of the utterance 'o namoRAdo megaLÓmano da brasiLEIra miRAva moREnas' (*the Brazilian's girl megalomaniac boyfriend looked at the dark-haired women*), produced as a neutral declarative and showing phrasing into two intonational phrases due to the presence of the long subject.

In declarative utterances comprising several intonational phrases, such as those that include parenthetical expressions, a topic phrase, or a long subject, the right-edge of each IP is marked by a boundary tone: usually, utterance-initial IPs and even medial IPs (like in parentheticals) are signalled by a High boundary (H%), whereas utterance-final IPs are naturally signalled by a Low boundary (L%), as well as some non-final IPs like the one that precedes a topic phrase. Examples of typical continuation rise contours found in non-final IPs are given in Figures 1 and 4 (see also Frota et al. 2007). Figure 5 illustrates the typical contour of utterances with a final topic.[3]

[3] Arguments for the presence of L% at the right-edge of IPs, and against the absence of a tonal target (0%), are found in Vigário 1998, Frota 2000, 2002a).

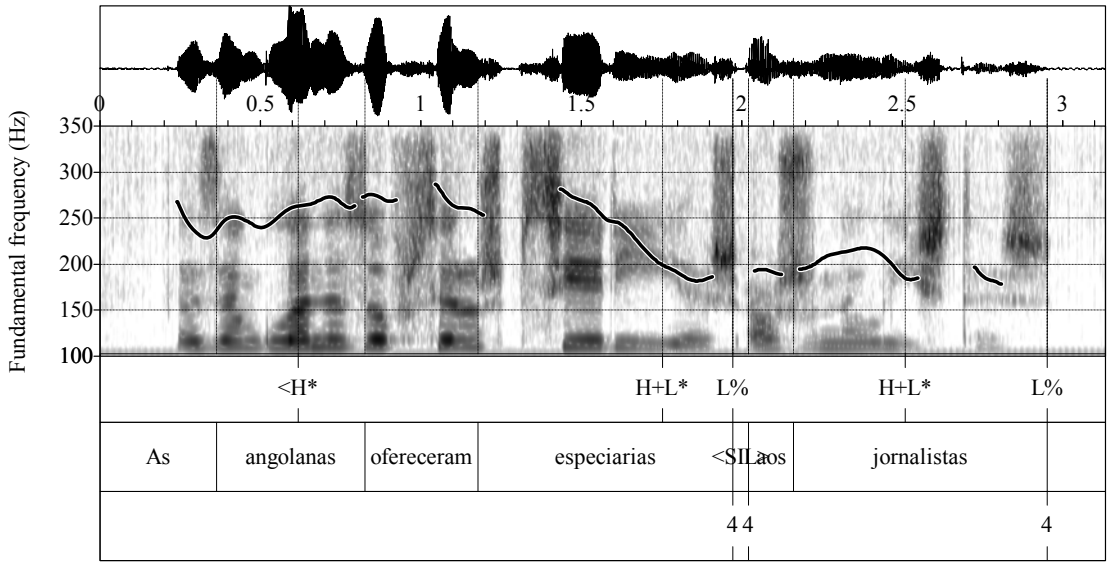



Figure 5. Fo contour of the utterance 'as angoLAnas ofereCEram especiaRIas aos jornaLIStas' (*the Angolan girls offered spices to the journalists*), with the phrase 'aos jornalistas' uttered as a final topic (see also (10c) in section 3.2.4).

The neutral declarative intonation just described, with its H+L* L% nuclear contour, contrasts with the contour of declarative utterances in which a particular constituent is focalized, and thus the neutral/broad focus reading is lost in favour of a narrow/contrastive focus reading. The focus contour is characterized by a peak on the stressed syllable of the focalized word, immediately followed by a fall. The contrast between the neutral contour and the focus contour is depicted in Figure 6: crucially, the two contours differ in the location of the peak and the fall relative to the nuclear syllable (H+L* versus H*+L). The realization of the peak within the nuclear syllable in the focus contour, as well as the tight timing relationship between the peak and the Low are independent of the late or early position of the focus in the utterance. Furthermore, this pattern is consistent, regardless of the number of pre or post-tonic syllables in the nuclear word, and of the distance from and to a phrase boundary (as quantitatively shown in Frota 2002a). This is illustrated by the contours in Figures 7-8.

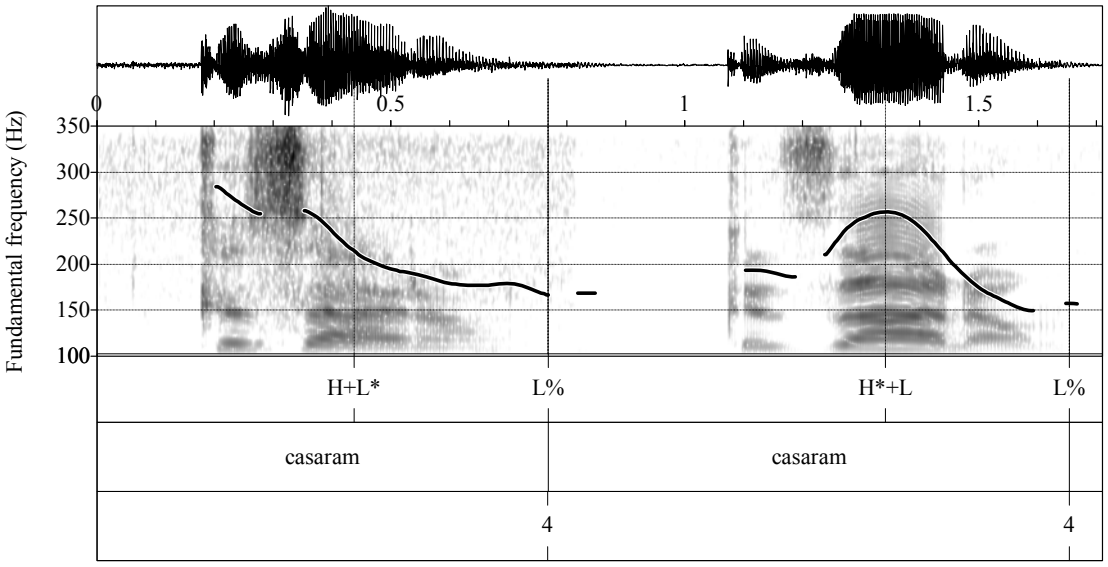



Figure 6. Fo contour of the utterance ‘caSAram’ (*they got married*), produced as a neutral declarative (as in an answer to *What about John and Mary?*), and uttered as a focus (as in an answer to *Did they break up?*).

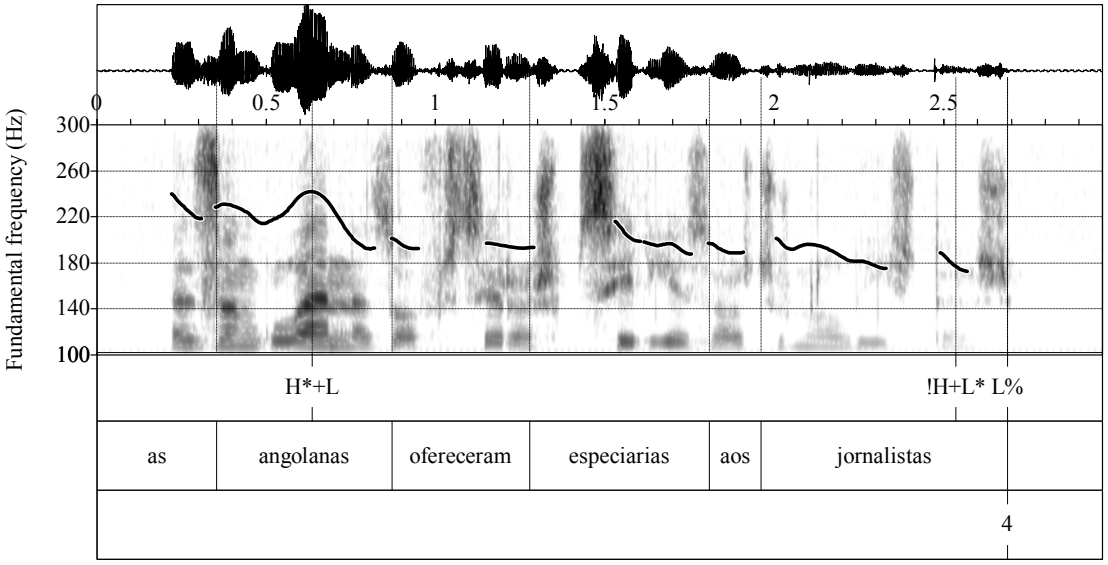



Figure 7. Fo contour of the utterance ‘as angoLAnas ofereCEram especiaRIas aos jornaLIStas’ (*the Angolan girls offered spices to the journalists*), with focus on ‘as angolanas’ (as in an answer to *Who offered spices to the journalists?*).

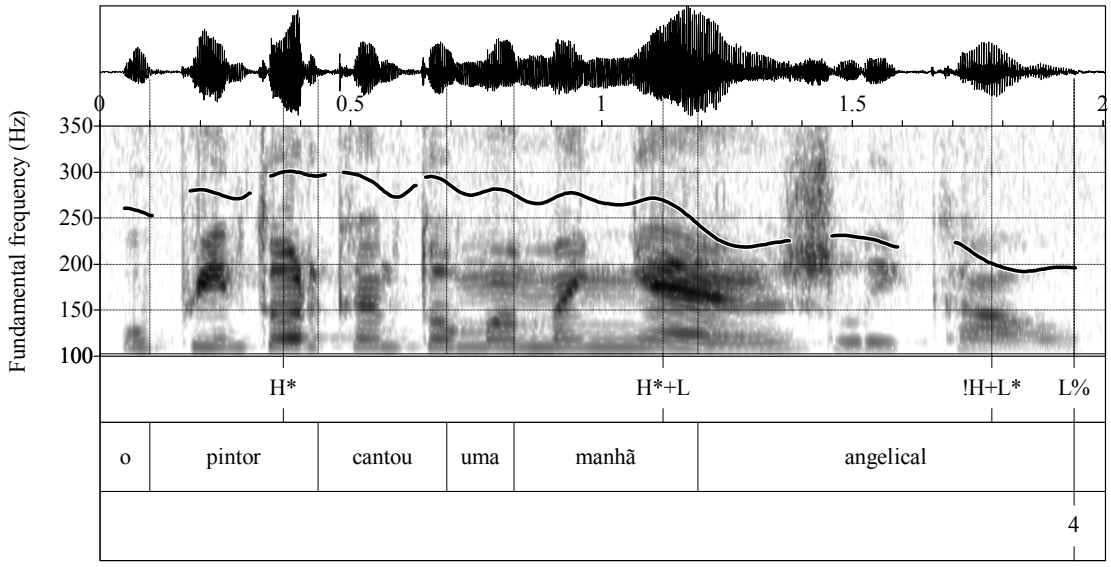



Figure 8. Fo contour of the utterance 'o pinTOR canTOU uma maNHÃ angeliCAL' (*the artist sang an angelic morning*), with focus on 'manhã' (as in an answer to *Was it an angelic night that the artist sang?*).

We saw in section 3.2.4 that the presence of a focus does not change the prosodic phrasing patterns regularly obtained in neutral utterances. However, it does have an effect on phrasal prominence and intonation: (i) the focus is the IP-head irrespective of the (early or late) position in which it occurs in the IP (i.e. there is no edge-alignment of focus with a prosodic phrase in EP); (ii) focus prominence is always signalled by lengthening, and late focus lengthening was found to be significantly different from default prominence lengthening (Frota 2000: Chap.5); (iii) focus is tonally expressed by means of a particular pitch accent, H*+L.[4] The EP data argue for a prominence-based account of the prosodic reflexes of focus, being the tonal effects predictable consequences of focus prominence (Frota 2000, 2002c; a proposal along these lines is developed in Selkirk 2005).

Besides inducing the presence of a special pitch accent, focus prominence also triggers (post-nuclear) pitch accent subordination in EP. This is shown in Figures 7 and 8. In

[4] A perception study reported in Frota (2000: Chap.6) shows that subjects reliably distinguish focus prominence from neutral prominence.

the contour in Figure 8 in particular, where the early nucleus is not too far away from the last stressed syllable of the IP, the presence of a post-nuclear accent on this syllable is clear. The post-nuclear accent is always (a reduced) H+L*.

### 3.3.2. Questions

In this section, the intonation of wh-questions, neutral yes-no questions and focused yes-no questions is described. While wh-questions are syntactically and lexically marked in EP, yes-no questions show the same surface syntactic properties as declaratives, and have no lexical marker.

Descriptions of question intonation in EP, whether from a phonetic (Viana 1987, Mata 1999, Falé 2005) or phonological point of view (Cruz-Ferreira 1980, 1998, Viana 1987, Frota 2002b, Vigário & Frota 2003), point to similarities between wh-questions and declaratives. In either case, the prenuclear contour shows a high plateau and the nuclear contour consists of a sharp final fall in the last stressed syllable of the IP (H+L* L%). An example of the wh-question contour is provided in Figure 9. A variant of the wh-question contour, which adds additional politeness to the question, shows a final rise after the accentual fall, instead of the low ending, similarly to the intonation of yes-no questions (Cruz-Ferreira 1980, 1998, Frota 2002b).

The distinctive feature of yes-no questions with respect to declaratives is the obligatory final rise. The shape of the remnant contour, however, is similar to both the declarative and wh-question tunes (Figures 10-12): the prenuclear contour typically consists of a high plateau, and the nuclear syllable shows a sharp fall (H+L*). The rise that follows the accentual fall has clearly a boundary nature, as both the beginning and end of the rise are aligned with the boundary syllable (Figures 10-12). In addition, it is not the case that the Low edge-tone spreads to the left, thus controlling the pitch between the pitch accent and the boundary as expected from a Low phrase accent (e.g. Beckman & Pierrehumbert 1986,

Beckman, Hirschberg & Shattuck-Hufnagel 2005). What is found in EP is simple interpolation between the accentual H+L* and the bitonal boundary tone, LH% (as shown in Figure 12, and like in Bengali – Hayes & Lahiri 1991a). The contour of yes-no questions with an early focus provides further arguments for the bitonal analysis of the boundary rise in questions.

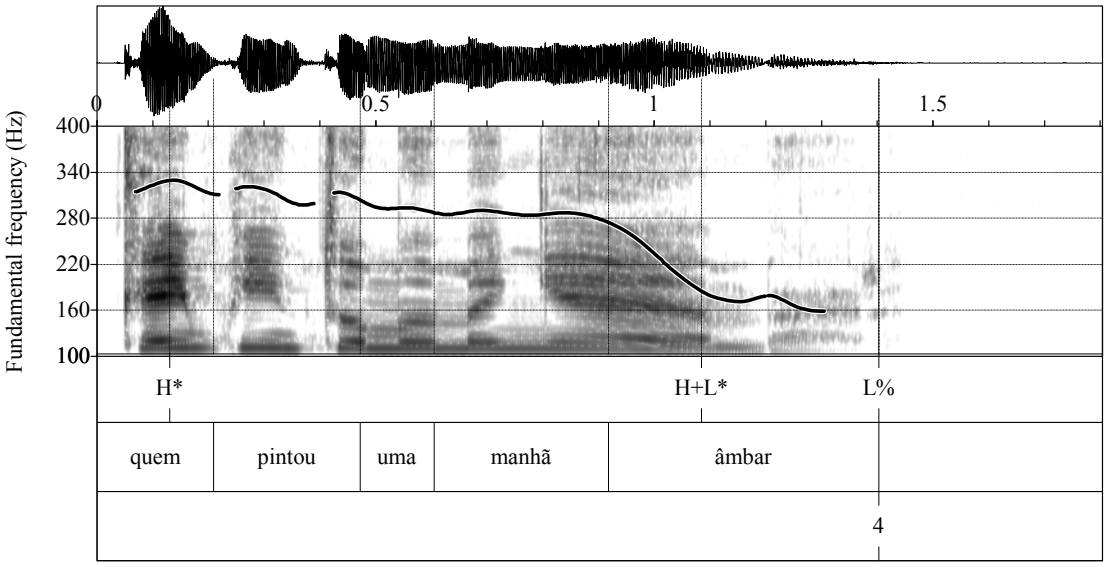



Figure 9. Fo contour of the utterance 'QUEM pinTOU uma maNHÃ ÂMbar?' (*Who painted an amber morning?*).

Like with declaratives, the contour of yes-no questions in which a particular constituent is focalized contrasts with its neutral counterpart. The most salient differences are the following: in focused questions, the nuclear syllable shows low-rising pitch instead of the nuclear fall of neutral questions; in focused questions there is either a boundary rise or a boundary fall, whereas the boundary rise is an obligatory feature of neutral questions.

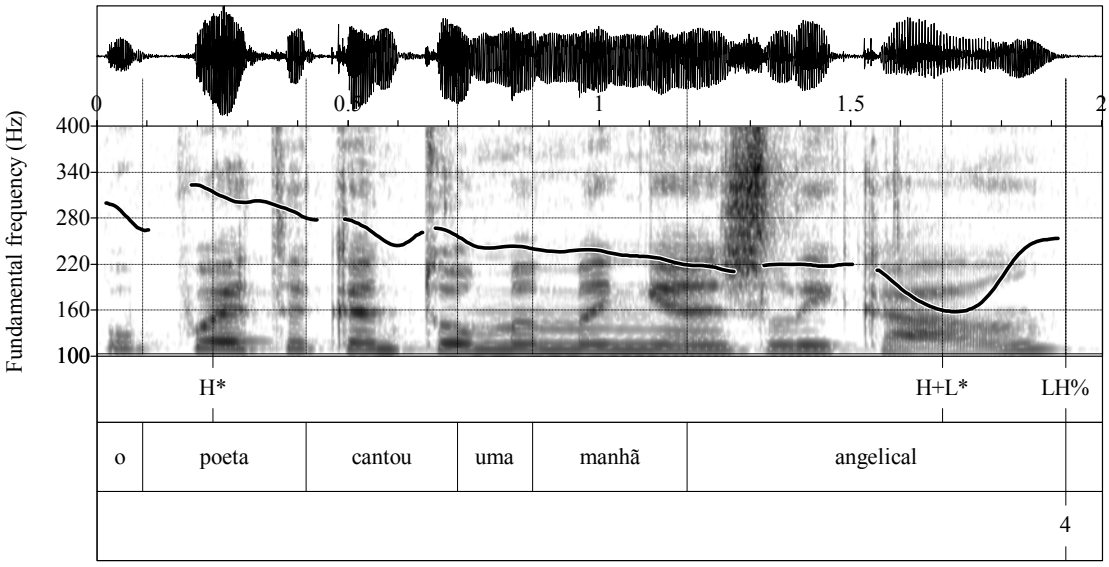



Figure 10. Fo contour of the utterance ‘o POEta canTOU uma maNHÃ angeliCAL?’ (*Did the poet sing an angelic morning?*).

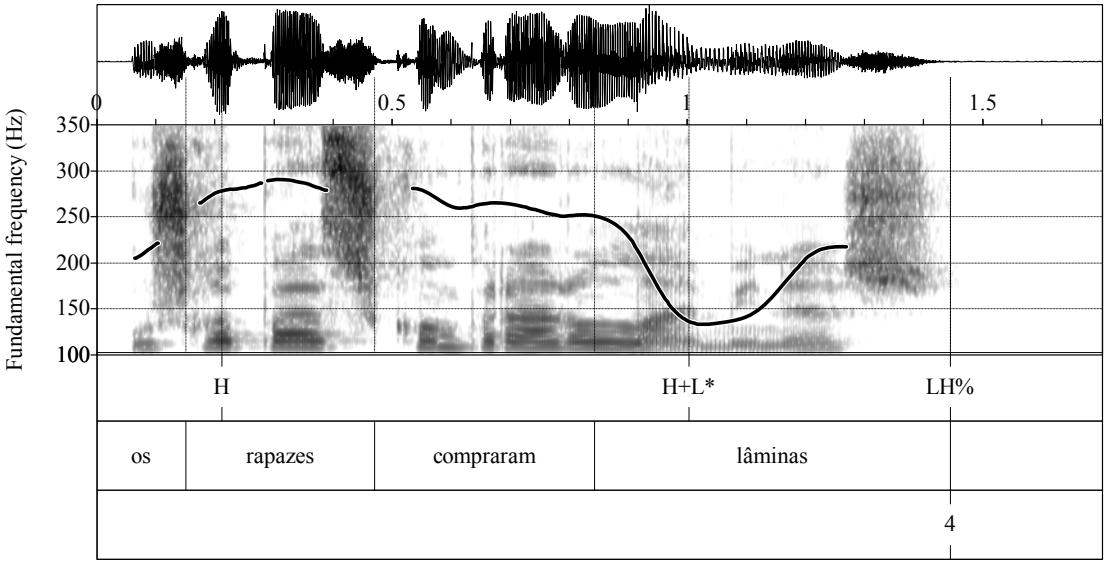



Figura 11. Fo contour of the utterance ‘os raPAzes comPRAram LÂminas?’ (*Did the boys buy slides (for the microscope)?*).

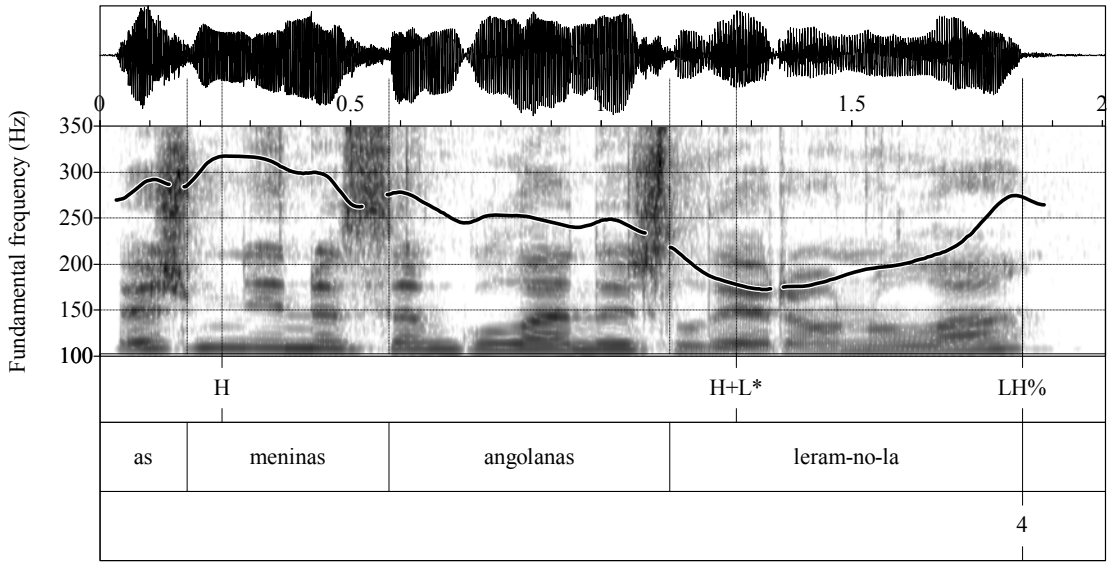



Figure 12. Fo contour of the utterance 'as meNInas angoLAnas LEram-no-la?' (*Did the Angolan girls read it to us?*)

The pitch of the nuclear accented syllable in the focus contour is low during a good portion of the syllable and then rises into the post-nuclear syllable, irrespective of the position of the nuclear word in the PhP or in the IP, and regardless of the number of post-tonic syllables available, as shown in Figures 13 to 15 (Fig. 13 can be compared to its neutral counterpart in Fig.11, and Fig. 15 with its neutral counterpart in Fig. 10). This tonal shape is thus described as a L*+H accent. If the focus in the yes-no question is final in the IP, a boundary fall follows (Figure 13); if it is not final, then a boundary rise signals the right-edge of the IP (Figures 14-15). The boundary rise shows the exact same properties described above for the bitonal LH% tone that characterises neutral questions (namely, a gradual fall appears between the accent and boundary showing that the pitch is not controlled by the Low tone, and the steep boundary rise is located on the final syllable).

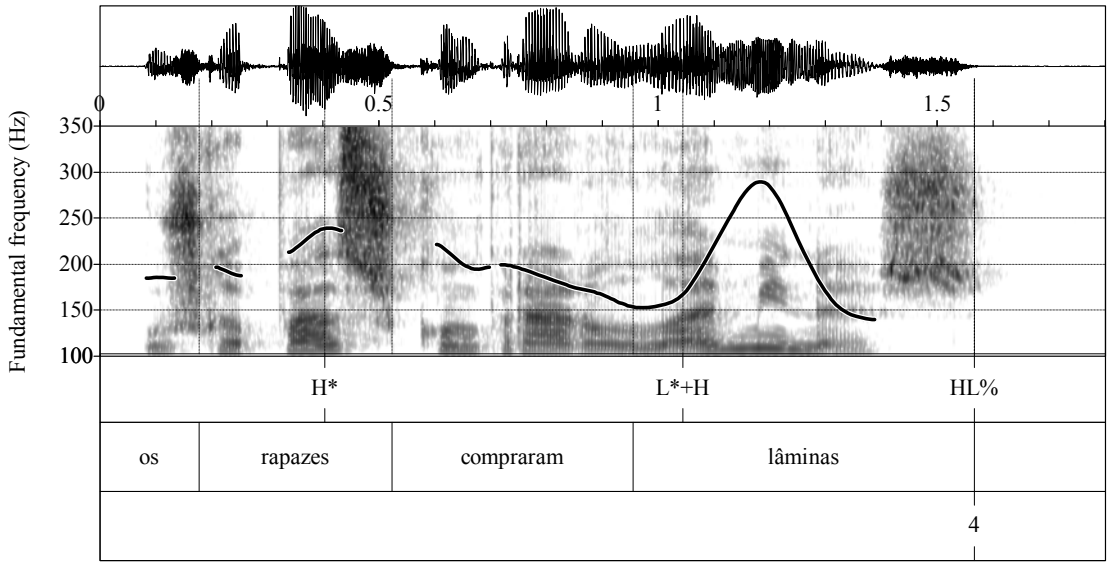



Figure 13. Fo contour of the focused yes-no question 'os raPAzes comPRAram LÂminas?' (*Did the boys buy slides?*), with the focus on 'lâminas' (as uttered in the context *I would like to know if they really bought slides and not any other accessory*),

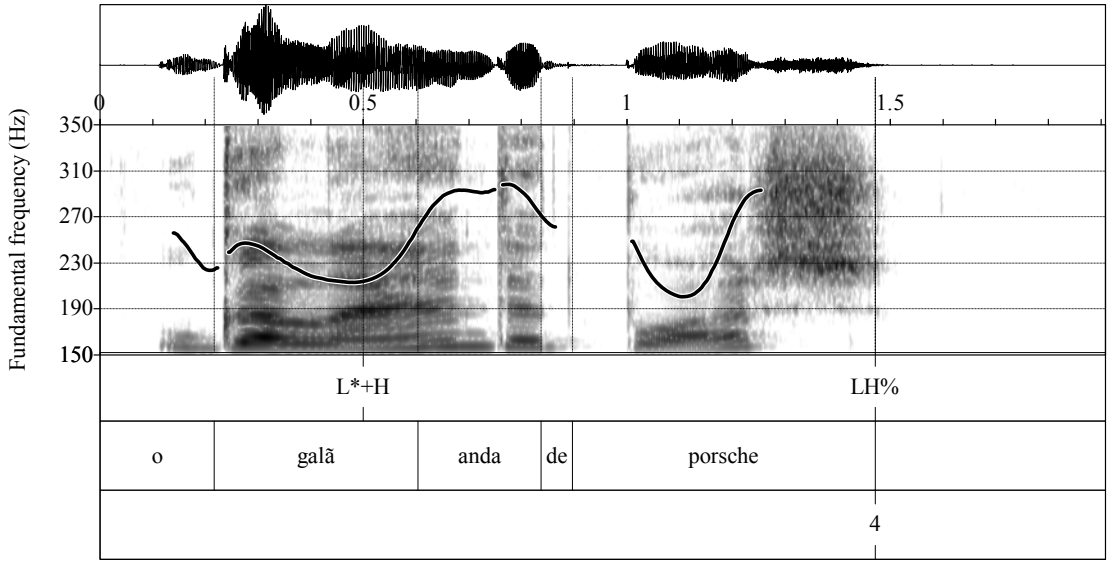



Figure 14. Fo contour of the focused yes-no question 'o gaLÃ ANda de PORsche?' (*Does the hero drive a Porsche?*), with the focus on 'o galã' (as uttered in the context *I have seen that movie but I don't remember who drives a Porsche*).

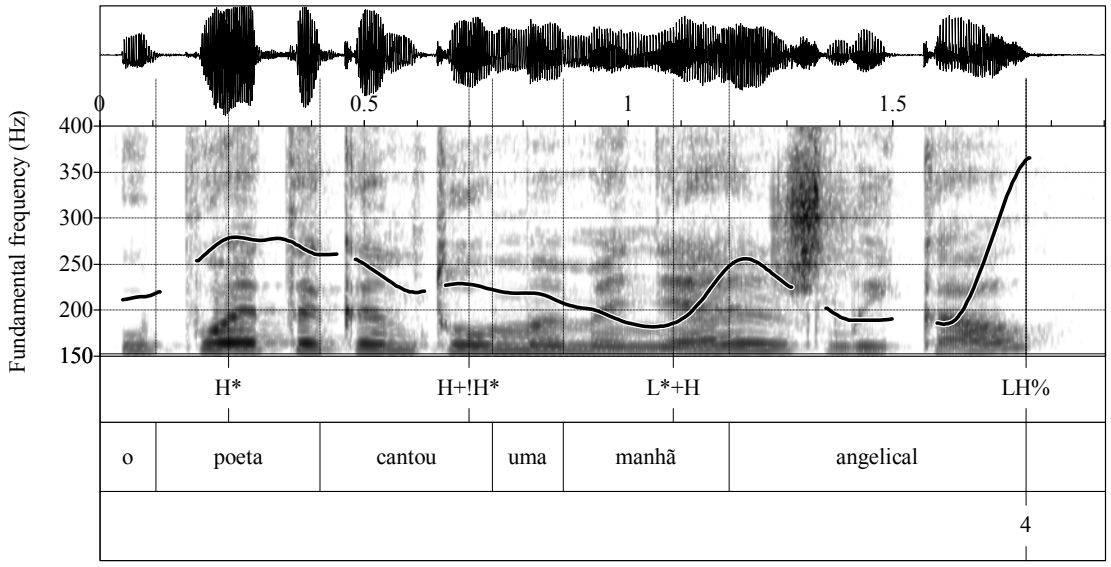



Figure 15. Fo contour of the focused yes-no question 'o POEta canTOU uma maNHÃ angeliCAL?' (*Did the poet sing an angelic morning?*), with the focus on 'manhã' (as uttered in the context *I've read that poem but I don't remember what part of the day the poet describes as angelic*).

Similarly, the boundary fall in the late nucleus case is also located on the right-edge. Such a fall could result from either the transition of the high accentual target into a low boundary, or from the presence of a bitonal HL%. However, both alignment facts in the presence of additional post-stressed syllables and the height of the peak argue in favour of the bitonal boundary (Frota 2002b). The latter is illustrated in Figure 13, where the final (accentual) peak is not only much higher than the first peak but also higher than the accentual peak in the early focus cases, a phonetic effect straightforwardly accounted for by upstep due to the presence of two successive high targets (L*+H HL%; for other cases of upstep in EP see Vigário 1998). The distribution 'early focus plus boundary rise' versus 'late focus plus boundary fall' may be understood under a pragmatic account of the focus marker (that is, the nuclear pitch accent), the interrogative marker (that is, the bitonal boundary tone), and the interaction between the two. A combination of the interrogative marker with the neutral accent indicates

a broad yes-no question.[5] The presence of the focus marker L*+H in a question indicates a focused question, that is a question where a specific constituent (the one bearing L*+H) is being questioned about. Thus the focus marker simultaneously carries the meaning interrogation, making the boundary rise redundant, in particular in the presence of a late nucleus. If the question focus is not final, then L*+H is farther away from the phrase edge and some ambiguity may arise as to the global status of the IP as a question. In this case, LH% clarifies the interrogative status of the IP (Frota 2002b).

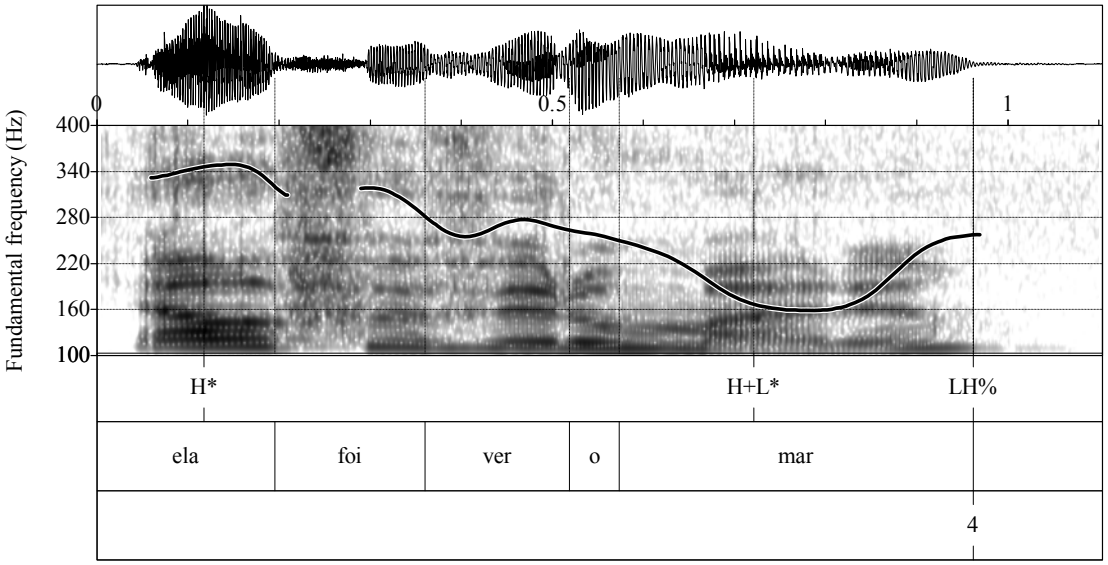



Figure 16. Fo contour of the utterance 'Ela FOI VER o MAR?' (*Has she gone to see the sea?*). The boundary rise is realized in the epenthetic vowel.

Question intonation clearly shows that EP is not a truncation language. On the contrary, when a sequence of tones is linked to a single syllable (as in utterances that end in the nuclear syllable), the segmental string is extended to cope with tonal realization. There

[5] Falé (2005) and Falé & Faria (2006) addressed the issue of perception of the declarative/interrogative distinction using the Categorical Perception paradigm. The identification results show that the distinction is categorical, whereas a consistent peak of discrimination in the cross-over between categories was not found. It is, however, important to note that stimuli manipulation did not take into account alignment of tonal targets, in particular the boundary rise was designed as continuous pitch rising from the last stressed vowel into the utterance edge.

are two possible ways of extending the segmental string: by means of lengthening of the nuclear vowel (as in 'cal' [ˈkaːɬ] in Figure 10), or by adding a new syllable via vowel epenthesis (a strategy available if a sonorant coda is present, as in 'mar' that may be produced as [ˈmaɾɨ], as in Figure 16).

### 3.3.3. Imperatives

In EP, imperative sentences, whether expressing commands or requests are usually characterized by being verb-initial, and by the use of the imperative mood and of the 2nd person in most of the cases. The intonation of imperative sentences is yet largely unstudied. The two phonological accounts available in the literature (Viana 1987, Cruz-Ferreira 1998) are sketchy, as this sentence type is just briefly mentioned and thus both phonological issues such as association and alignment of tonal events or the precise nature of the tonal categories, and pragmatic issues such as differences between commands and requests or other more subtle differences (e.g. insistence, politeness), are not addressed. Moreover, the descriptions disagree in that Viana approximates the intonation of commands to that of wh-questions, whereas Cruz-Ferreira mentions a nuclear low-falling tone that already begins at the bottom of the speaker's range. In Falé (2005) and Falé & Faria (2007) the intonation of imperatives is studied from a pure phonetic viewpoint. The following two major findings are reported: the toplines of imperatives show higher Fo in the vicinity of the last stressed vowel than in declaratives; the contours of commands and requests have the same topline shape, but Fo is higher in commands. As the authors resort to stylised representations of the F0 contours as toplines on the basis of a selection of specific datapoints (no actual contours are given), the phonetic description is hard to interpret phonologically. To our knowledge, this section provides the first detailed phonological account of imperative intonation in EP. Both commands and requests are addressed, as well as more subtle pragmatic distinctions within requests.

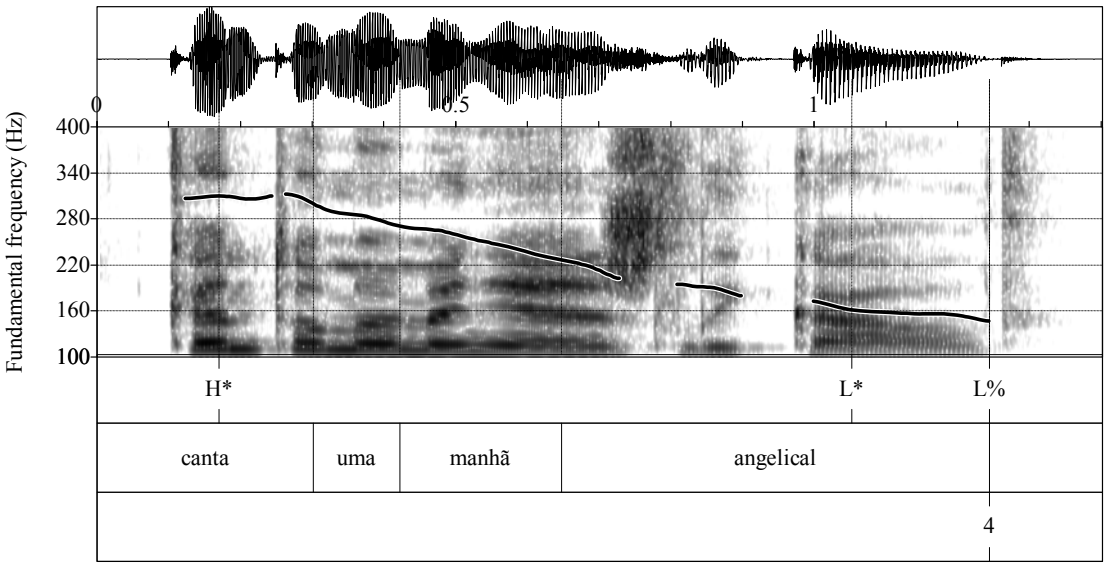



Figure 17. Fo contour of the utterance 'CANta uma maNHÃ angeliCAL' (*Sing an angelic morning*), produced as a request (the average rating for this utterance in the perception task was 2.6).

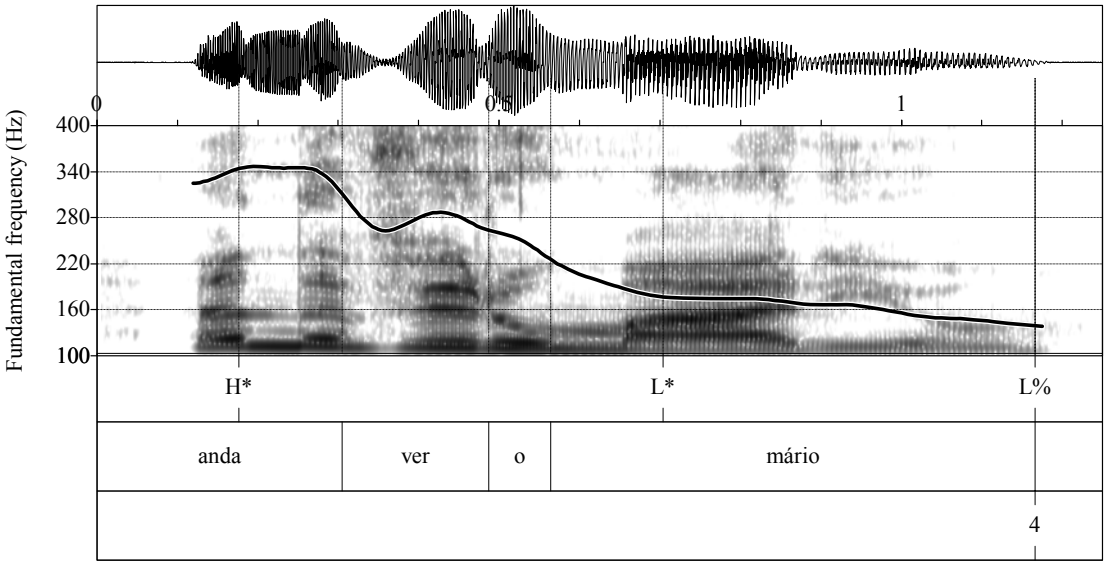



Figure 18. Fo contour of the utterance 'ANda VER o MÁrio' (*Come and see Mário*), produced as a request (the average rating for this utterance in the perception task was 2.2).

The data analysed shows two main patterns, respectively illustrated in Figures 17-18 and Figures 19-20: (i) a low nuclear accent on the last stressed syllable of the utterance, preceded by a peak on the first stressed syllable (H* L* L%); (ii) the use of the focus accents,

already described for yes-no questions and declarative sentences, as the early nucleus on the verb (either L*+H or H*+L), or of H*+L as the late nucleus on the verbal object (in either case the boundary tone is low). Crucially, the two patterns are not pragmatically equivalent: the first pattern expresses a request, whereas the second pattern expresses a command.

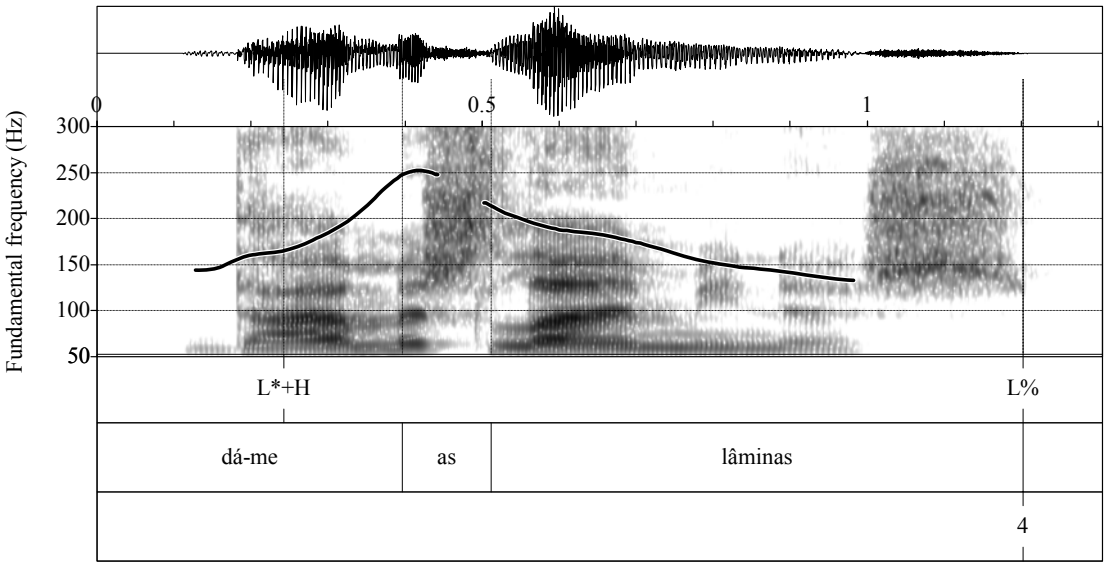



Figure 19. Fo contour of the utterance 'DÁ-me as LÂminas' (*Give me the slides*), produced as a command (the average rating for this utterance in the perception task was 4.3).

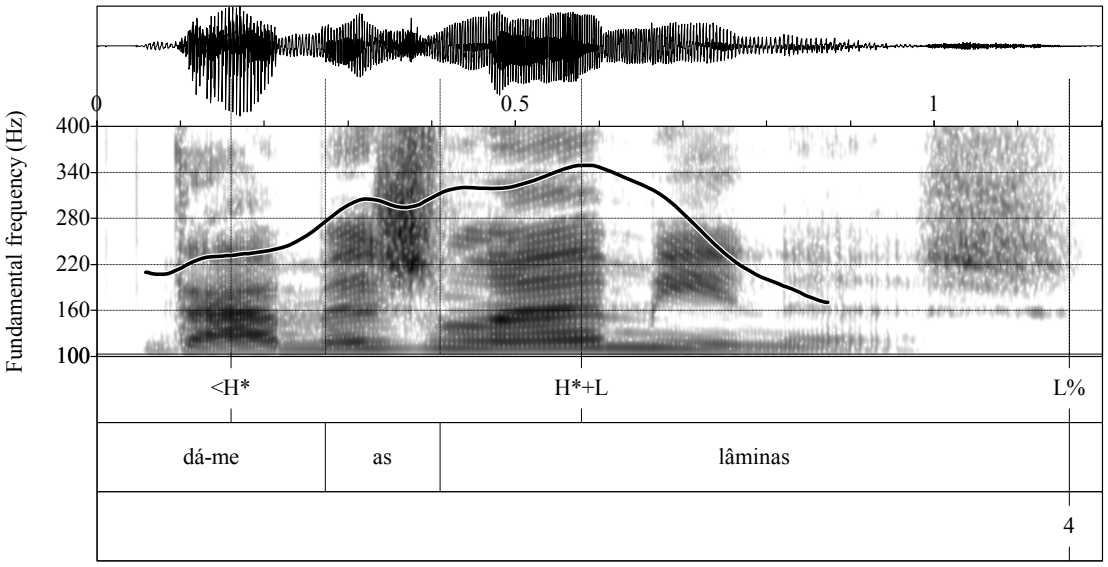



Figure 20. Fo contour of the utterance 'DÁ-me as LÂminas' (*Give me the slides*), produced as a command (the average rating for this utterance in the perception task was 4.1).

The most striking features of the first pattern (the request contour) are the following: the nuclear accent is L*, unlike in all the other sentence types previously described; the pitch within the nuclear vowel is all low (or just slightly falling during the first part of the vowel) and the vowel is lengthened; the pitch fall from the initial peak to L* starts on the 1st post-stressed syllable (or on the 2nd when the peak is aligned later). Figures 17-18 provide examples of these features.[6] By contrast, in the second pattern (the command contour) the key feature is the presence of a focus accent. Like in other focused utterances, in commands the focus may also be early or late. Focus distribution seems to interact with the choice between the two focus accents available in the language: if focus is early, both the accent previously found on focused questions (L*+H) or the accent that signals focus in declaratives (H*+L) may be used (Figure 19 and Figure 21); if focus is late, only the latter is a possibility (see Figure 20). This interaction is not surprising under the pragmatic account of the focus and interrogative markers put forward in section 3.2.2: in the EP intonational system, a late focus expressed by L*+H, followed by falling pitch, would also express interrogation; by contrast, an early focus conveyed by L*+H and not followed by the right-edge rise that marks interrogation but by a Low boundary instead, such as in the case of the command contour, may unambiguously express a command.[7]

[6] Globally, and not considering the pitch accent association and alignment issues, as well as pitch accent status in the tune, this analysis is not too far from Viana's (1987) analysis of request/persuasion where the main tonal events are also an initial peak and a following low tone.

[7] The question of whether in commands with an early focus (that is focus on the verb) a post-nuclear accent may be present requires further research. If such a pitch accent is present, it is an L* as in the nucleus of requests, and thus pitch movement is not the best cue for it. However, preliminary data suggest that duration of the final stressed syllable may correlate with perceived post-nuclear accent, as is the case in Figure 21 but not in Figure 19.

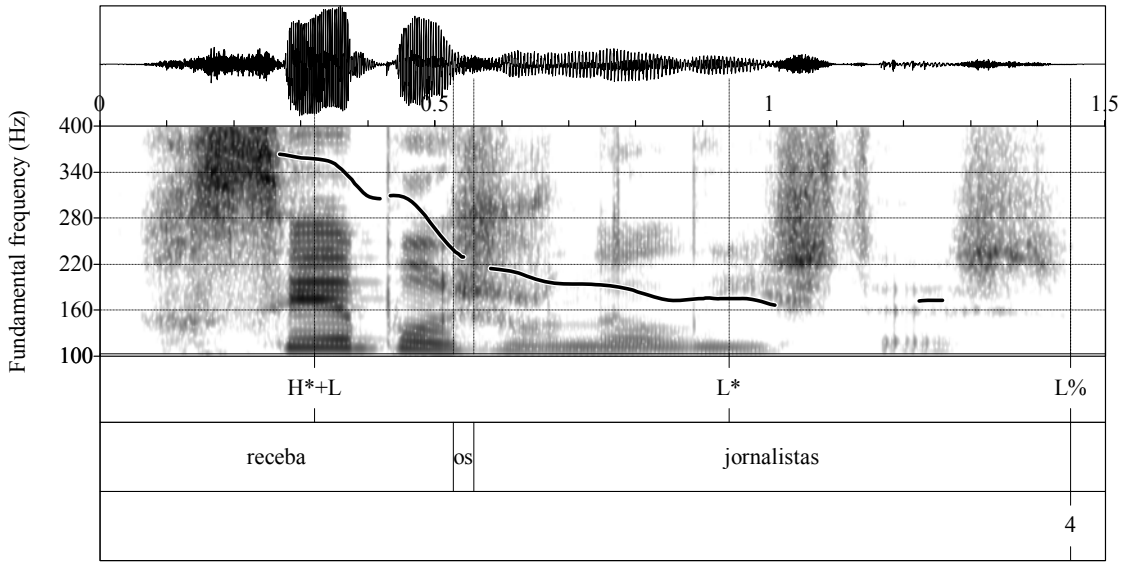



Figure 21. Fo contour of the utterance 'reCEba os jornaLIStas' (*Talk to the journalists*), produced as a command.

The pragmatic difference between the two types of contours described above is clearly supported by perception data. A section of the imperative utterances, representing the two contours types (as well as more subtle pragmatic differences among requests that will be mentioned later), were included as items in a perception task (in a total of 23 items). 15 subjects were asked to evaluate the items on a 5-point scale. The scale includes 3 options for requests (stated as gentle request (1), request (2) and insistent request (3) ) and two options for commands (stated as command (4) and strong command (5) ). Thus the request dimension is defined around point 2 of the scale, whereas the command dimension is defined on the upper extreme of the scale. Items are randomized and the subjects listened to each of the 23 utterances twice. The results confirmed the pragmatic difference between the two types of tunes (see Figure 22), by placing H* L* L% within the request dimension and the tunes with the focus accents within the command dimension (the difference in rating is significant: p=0.0003).

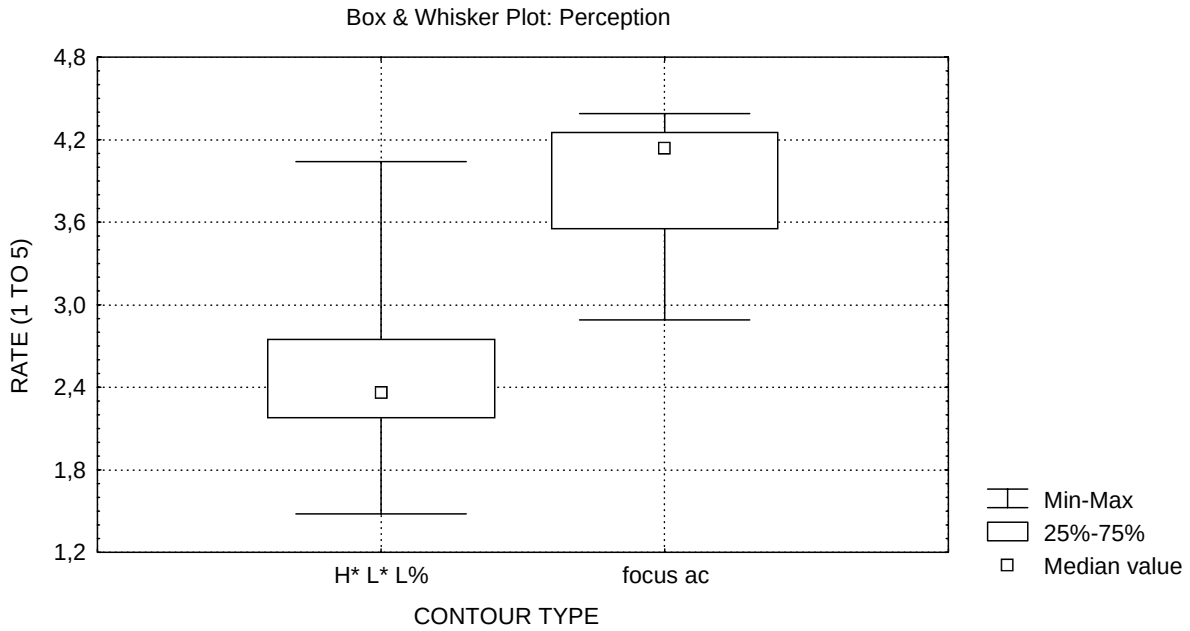



Figure 22. Box and whisker plot for the perception data on requests and commands by type of contour.

The perception results also show more variation within the request dimension.[8] The three options given to subjects are not the only factor behind this larger variation, as it is not the case that subjects systematically assigned the label 'gentle request' to some of the utterances, or the label 'insistent request' to other utterances. In fact, variation across subjects (and within subjects) is paramount in the request dimension. While this may mean that the labels provided are not the best to capture the more subtle pragmatic differences at hand, it may also mean that such differences are indeed harder to distinguish due to their more gradual-like (and perhaps also subjective-like) nature. An example of such a case is given in Figure 23, where the H* L* L% contour is uttered with a much higher peak and longer vowel durations, adding a 'begging' flavour to the request. These properties seem to be interpreted by some subjects as conveying a 'gentle request', by others as expressing an 'insistent request', and even as both one or the other by the same subject.

[8] In Falé & Faria's (2007) study, and although the kind of perception task used is very different from the one I have applied, it is also reported that requests are more difficult to rate than orders (i.e. only 23% of the request items were considered good cases of requests contra 50% for the orders).

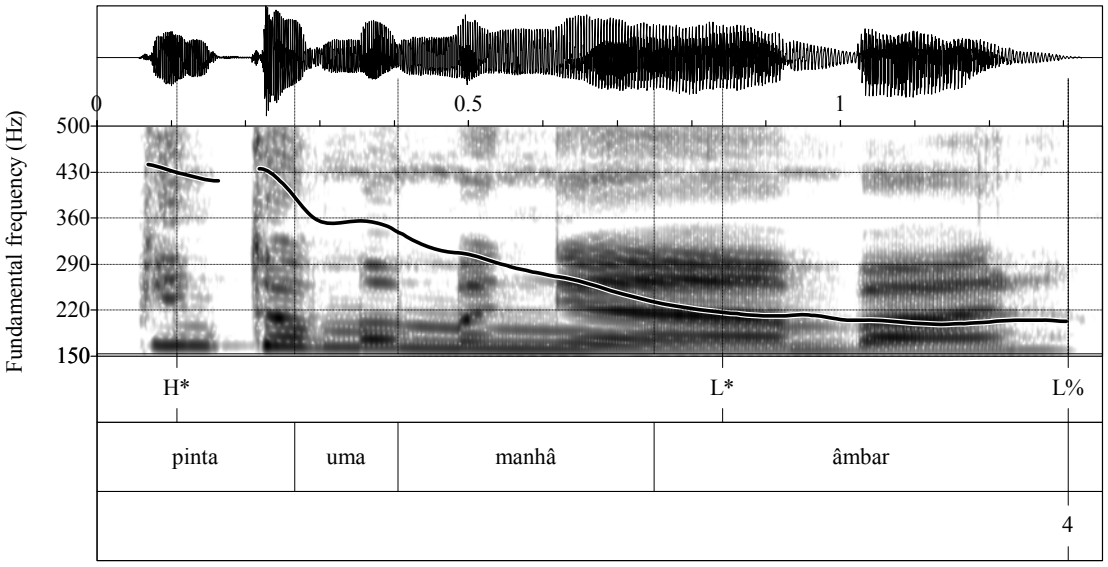



Figure 23. Fo contour of the utterance 'PINta uma maNHÃ ÂMbar' (*Paint an amber morning*), produced as a 'begging' request (the average rating for this utterance in the perception task was 2.25).

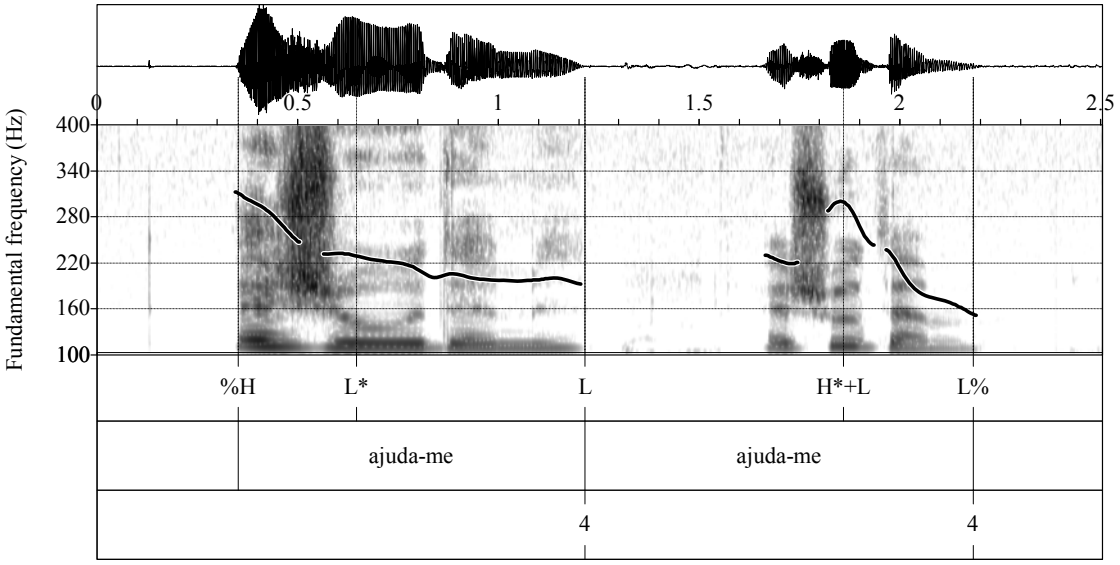



Figure 24. Fo contour of the utterance 'aJUda-me' (*Help me*), produced as a request and as a command.

To conclude this section, the intonation of one-word imperatives is analysed. The main features of both the request and command contours are maintained in one-word utterances: the former begin high, and the stressed syllable shows the nuclear L*, as well

vowel lengthening; the latter begin low and the focus accent H*+L is associated to the stressed syllable (Figure 24). The high beginning in the request contour strongly suggests that this tune requires a HL melody, that is realized as H* L* when more than one stressed syllable is available, and as an initial edge tone %H and L* if just one stressed syllable is present.

In European Portuguese, imperative intonation in both requests and commands is crucially conveyed by pitch accent choice and not by final boundary marking, unlike in languages such as Catalan, Korean or Chickasau, which highly differ in their prosodic and intonation systems but share the use of boundary marking (LHL% or HL%) in the intonation of requests and/or commands (respectively, Prieto 2004, Prieto et al. 2007, Jun 2005, and Gordon 2005).[9]

3.3.4. **Vocative chant**

The intonation of calling has not attracted the attention of researchers on EP prosody. This section thus provides the first phonetic and phonological description of calling contours in this language. Calling contours have been shown to have strong similarities across European languages, but also systematic differences in tune-text association that apparently reflect language-specific structural properties, and specific languages may use different variants of the calling contour linked to particular pragmatic meanings (Gussenhoven 1993, Ladd 1996, Prieto 2002).

In EP, there are two variants of the calling contour: the sustained pitch variant (the typical vocative chant), characterized by high pitch on the nuclear syllable and a downward step into the first post-tonic syllable after which the pitch level is sustained until the end of the contour; the low pitch variant (low vocative chant), also characterized by high pitch on

[9] Interestingly, in a very few cases a reduced rise-fall (!HL%) follows the nuclear L*, adding an insistent note to the request. So, it may well be that in EP boundary marking is subsidiary to request intonation and used to signal more subtle pragmatic differences within the request dimension.

the nuclear syllable, immediately followed by a gradual fall until the end of contour. The two variants are pragmatically distinct: the low vocative chant expresses an insisting impatient call that would be pragmatically inadequate if used as an instance of a greeting or first call. Examples of the two calling contours are given in Figures 25-29.

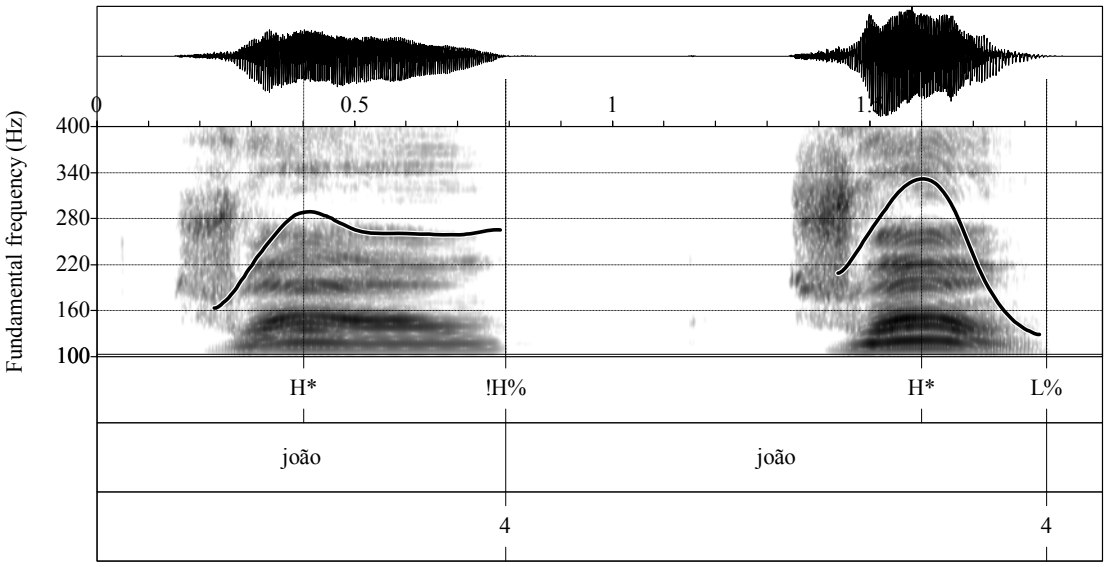



Figure 25. Fo contour of the utterance 'JOÃO' (*John*), produced as a greeting/first call and as an insisting impatient call.

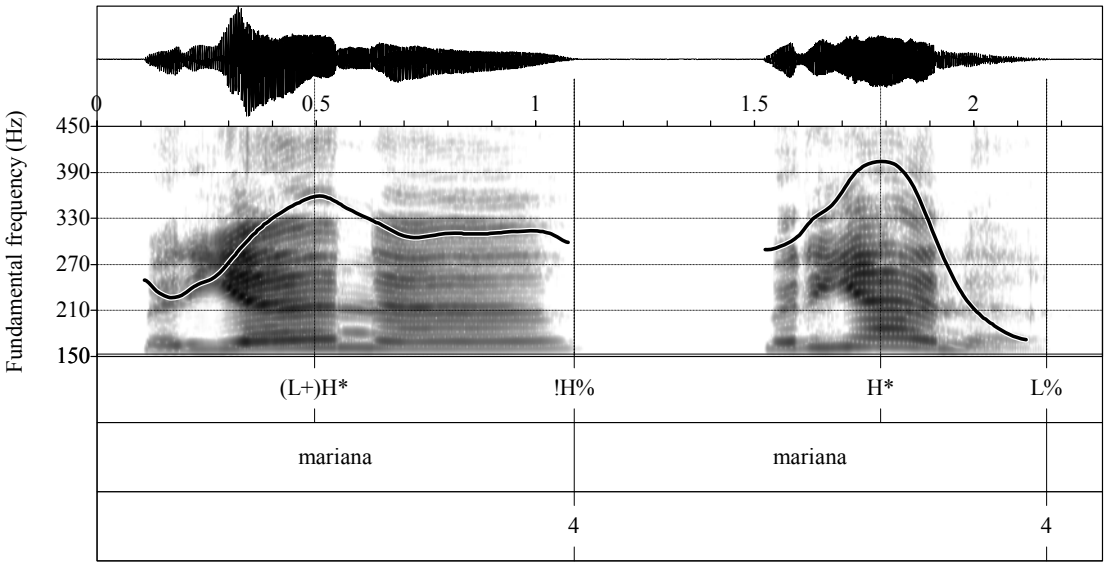



Figure 26. Fo contour of the utterance 'maRIAna' (*Marianne*), produced as a greeting/first call and as an insisting impatient call.

The patterns of tonal alignment in the typical variant of the vocative chant are as follows. The peak is always attained in the nuclear vowel, irrespective of number of pre-stressed syllables (from 0 to 3, in our data) and the sustained pitch usually aligns with the beginning of the first post-tonic syllable. The rise to the nuclear peak may start from the beginning of the utterance (as in Figure 27) or be aligned to the left edge of the nuclear syllable (as in Figure 28), thus suggesting the optional presence of a low prefix to the nuclear peak.[10] In the greeting call, the nuclear syllable and most particularly the boundary syllable are lengthened. Importantly, the requirement for extended duration of the boundary syllable blocks post-tonic phonetic vowel reduction or even vowel deletion (as in the case of [u] and [ɪ]) that generally characterize the language (Vigário 2003: Chap.7). Consequently, in calling sequences final unstressed vowels are necessarily fully realized, as shown in 'Maximilian[u]' (Figures 27-28) and 'Álvar[u]' (Figure 29). The same lengthening requirement leads to the split up of the nuclear syllable when no post-tonic syllable is available, as in 'João' [ˈʒwɐ.ɐ̃w̃ ] (Figure 25). In the case of VV sequences that yield diphthongs, another splitting option is available by the realization of the high V as a full vowel instead of a glide, as in [ˈʒwɐ̃.u]. Given the properties just described, the greeting call is analyzed as (L+)H* !H%, with spreading of !H% in the post-tonic stretch. The extended duration of the boundary syllable is taken to go hand in hand with the special nature of !H% in this contour: this is the only edge tone that clearly shows a spreading behaviour in EP. Although the issue requires further inspection, the spreading nature of this tone may be argued to be phonological, due to the consequences it has for phonetic vowel reduction and deletion, and diphthongization.[11]

[10] This additional low target has apparently no consequences for the pragmatic meaning of the contour.

[11] Hayes & Lahiri (1991b) have argued for phonological lengthening as a feature of the calling contour, as it neutralizes the distinction between long and short vowels in the languages analyzed.

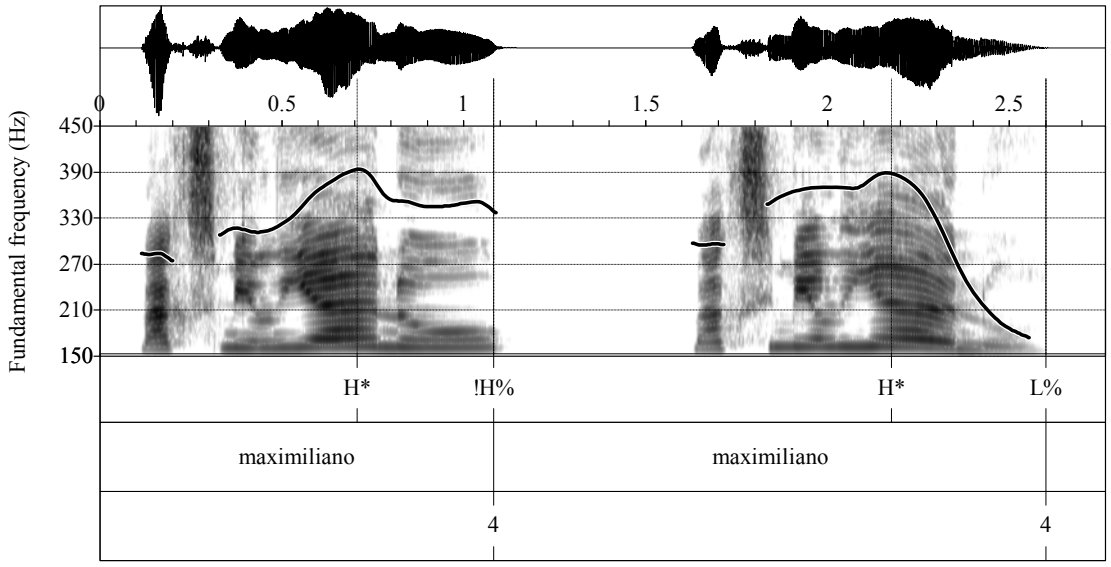



Figure 27. Fo contour of the utterance 'maximiLIAno' (*Maximiliano*), produced as a greeting/first call and as an insisting impatient call.

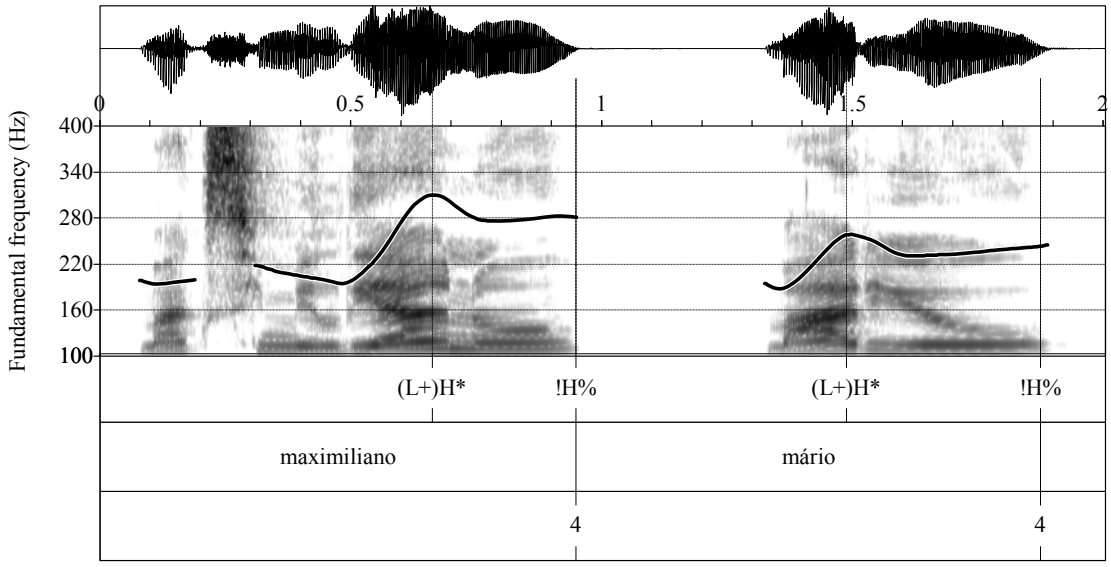



Figure 28. Fo contour of the utterances 'maximiLIAno' (*Maximiliano*) and 'MÁrio' (*Mário*), produced as a greeting/first call.

The low vocative chant also shows a peak in the nuclear vowel and similarly to the greeting call the rise to the peak may start from the beginning of the utterance or just before the nuclear syllable. However, unlike in the greeting call, the peak is followed by falling pitch: the fall may start already in the nuclear vowel and reaches its endpoint on the final

syllable (Figures 26, 27 and 29). Also unlike in the greeting call, there is no split up of the nuclear syllable if no post-tonic syllable is available: in this case, both the peak and the fall are realized in the nuclear syllable (Figure 25). In the low vocative chant, the boundary syllable does not exhibit the extended duration that characterizes it in the H* !H% contour: a comparison of the absolute duration of the boundary syllable in both contours in multisyllabic utterances by the same speaker shows that in H* !H% this syllable is 218 ms longer in average; in monosyllabic utterances the syllable is 97 ms longer in average. Overall, across multisyllabic utterances and speakers, the final syllable takes in average 48% of the duration of the whole word in the H* !H% contour contra 35% in the low vocative chant. Given the properties just described, this variant of the vocative chant is analysed as (L+)H* L%. The two variants are thus distinguished by type of boundary marking: the greeting call shows !H% with its special spreading and lengthening features, whereas the low vocative chant uses L%, the same boundary tone found in many other tunes (as in declaratives, wh-questions, or imperatives).

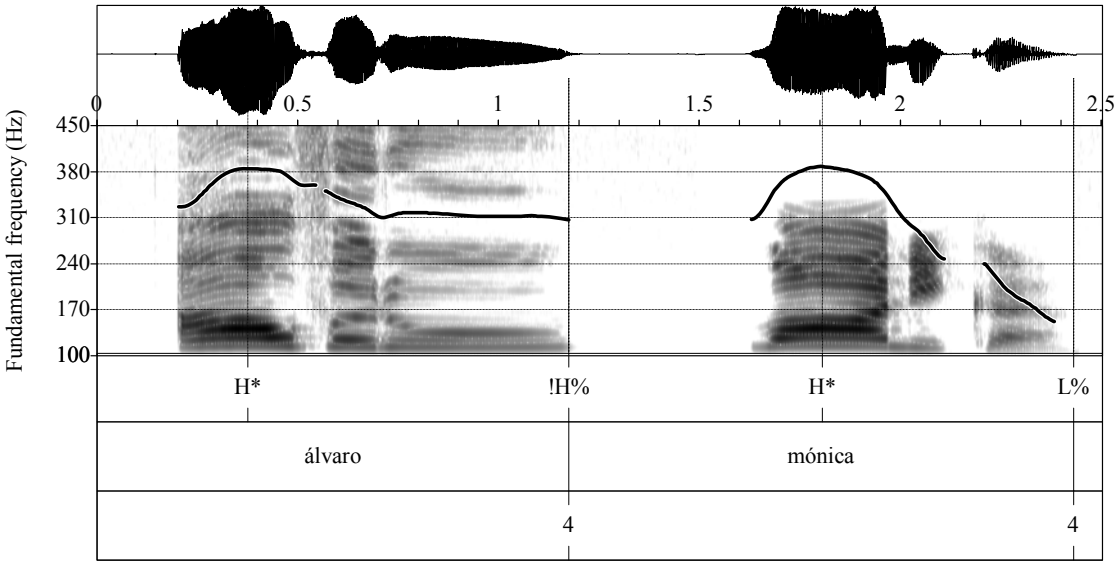



Figure 29. Fo contour of the utterances 'ÁLvaro' (*Alvaro*), produced as a greeting/first call, and 'MÓnica' (*Monica*), produced as an insisting impatient call.

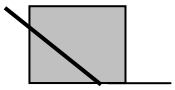
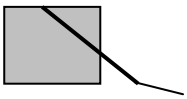
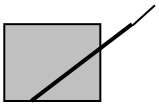
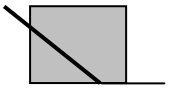
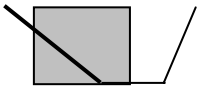
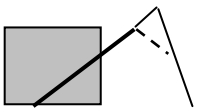
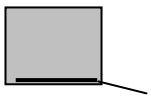
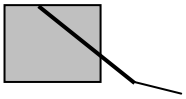
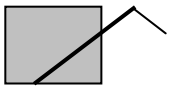
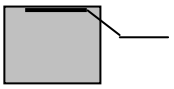
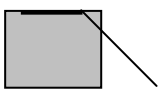
The melody of the low vocative chant can be contrasted with the focus accent H*+L described in section 3.3.1 above. Both melodies show the same two high and low tonal targets, with the peak aligned with the nuclear syllable (see, respectively, Figures 26 and Figure 6). However, in the focus accent the pitch fall in the syllable that immediately follows the stress is more abrupt regardless of the number of post-tonic syllables (section 3.3.1 and Frota 2002a), whereas in the calling contour the fall is less steep the more the nuclear syllable is farther away from the boundary (see, for example, the gradual fall in the contour of ['mɔ.ni.kɐ] in Figure 29).[12] This is exactly as expected in a contour where the accentual peak and the fall are independent tonal events associated with different sites in the prosodic structure of the utterance, as in the low vocative chant.

### 3.3.5. Intonational analysis: summary

In Table 1, the properties of commonly occurring EP tunes are summarized. For ease of reference and cross-checking, the numbers of Figures with relevant exemplification are added, as well as the indication of the nuclear words in the examples (with the stressed syllable in capitals). The schematic representation of the realization of nuclear contours assumes a stressed syllable (signalled by the box) and a following syllable.

[12] In measurements over a sample of 10 nuclear words with antepenultimate stress, it was found that while more than 55% of the fall occurs within the first post-tonic syllable in H*+L, only 30% of the fall occurs in the first post-tonic in H* L%. In the latter case the fall is spread between the stressed syllable and the boundary syllable (respectively, 25%, 30%, 45%).

Table 1. EP tunes: labels, realization of the nuclear contour, usage.

| Labels | Realization | Context/Meaning | Examples |
|---|---|---|---|
| (H) H+L* L% |  | Neutral declarative | Fig.2: angeliCAL<br>Fig.3: lagaREIro<br>Fig.4: moREnas<br>Fig.6: caSAram |
| | | Topic phrase | Fig.5: jornaLIStas |
| (H) H*+L L%<br>(H) H*+L !H+L* L% |  | Focused declarative<br>Early focus | Fig.6: caSAram<br>Fig.7: angoLAnas<br>(final PW: jornaLIStas)<br>Fig.8: maNHÃ<br>(final PW: angeliCAL) |
| L*+H H% |  | Continuation<br>Parenthetical | Fig.4: brasiLEIra<br>Fig.1: saBEmos |
| (H) H+L* L% |  | Wh-question | Fig.9: ÂMbar |
| (H) H+L* LH% |  | Neutral yes-no question | Fig.10: angeliCAL<br>Fig.16: MAR<br>Fig.11: LÂminas<br>Fig.12: LEram-no-la |
| (H) L*+H HL%<br>(H) L*+H LH% |  | Focused yes-no question<br>Early focus (dashed line) | Fig.13: LÂminas<br>Fig.14: gaLÃ<br>(final PW: PORsche)<br>Fig.15: maNHÃ<br>(final PW: angeliCAL) |
| H* L* L% |  | Request (multiword) | Fig.17: angeliCAL<br>Fig.18: MÁrio<br>Fig.23: ÂMbar |
| %H L* L% | | Request (one word) | Fig.24: aJUda-me |
| (H) H*+L L%<br>H*+L (L*) L% |  | Command (late focus)<br>Early focus | Fig.20: Lâminas<br>Fig.21: reCEba<br>(final PW: jornaLIStas) |
| L*+H (L*) L% |  | Early focus | Fig.19: DÁ-me<br>(final PW: LÂminas) |
| (L+)H* !H% |  | Vocative chant (greeting) | Fig.25: JOÃO<br>Fig.26: maRIAna<br>Fig.27: maximiLIAno<br>Fig.28: MÁrio<br>Fig.29: ÁLvaro |
| (L+)H* L% |  | Low vocative chant<br>(insisting call) | Fig.25: JOÃO<br>Fig.26: maRIAna<br>Fig.27: maximiLIAno<br>Fig.29: MÓnica |

## 4. Prosodic phrasing and intonation across varieties

This section describes briefly some critical differences on phrasing and intonation patterns across varieties of Portuguese. The standard variety, which is the focus of this chapter, is compared to the Northern variety (as spoken in the urban area of Braga) with respect to declarative and question intonation, as well as pitch accent choices and prosodic phrasing patterns in declaratives (Vigário & Frota 2003, Frota & Figário 2007, Frota et al. 2007). The standard European variety is also compared with the Brazilian variety (as spoken in S. Paulo) with regard to declarative intonation (Frota & Vigário 2000, Tenani 2002, Fernandes 2007).

It was shown in section 3 that H+L* is the nuclear accent in the neutral declarative, wh-question and neutral yes-no question tunes in the standard variety. In Northern EP (hereafter NEP), this role has been shown to be played by L* instead (Vigário & Frota 2003): L* L% is the most common nuclear contour of both declaratives and wh-questions, and L* HL% the most common nuclear contour of yes-no questions. NEP also differs from the standard variety in its choice of nuclear accents for utterance-internal IPs: while L*+H or H*+L are the common choices in the former, in NEP the L* accent is also among the possible nuclear accents (Frota et al. 2007). However, the most striking prosodic difference between NEP and the standard variety seems to result from the length of prosodic phrases and the facts of pitch accent distribution.

The most common intonational phrasing pattern in NEP declaratives consisting of a subject, verb and object is the phrasing of these utterances into two IPs – (S) (VO) – and not into one IP, as in the standard variety (see section 3.2.5; see also Frota & Vigário 2007 for an account of the NEP phrasing pattern based on syntax-phonology mapping constraints). Therefore, for the same corpus of utterances (with an average length of 5.2 PWs), while in the standard variety 54.4% of the IPs produced have 4 or more PWs (section 3.2.5), in NEP 50% of the IPs have less than 3 PWs. The shorter phrases of NEP show a rich pitch accent

distribution: 74% of IP-internal stressed syllables were pitch accented in a corpus of utterances with 3 to 8 prosodic words, contra only 17% in the standard variety (Vigário & Frota 2003). It is thus clear that the relevant domain for pitch accent distribution in NEP is not the IP, as in standard EP, but a smaller prosodic domain. The available evidence strongly suggests that this domain is the phonological phrase, i.e. in NEP every PhP-head must be pitch-accented.

In the Brazilian variety of Portuguese (henceforth BP), declaratives show the H+L* L% nucleus as in standard EP (Frota & Vigário 2000, Tenani 2002, Fernandes 2007). However, this is apparently the only common feature between BP and EP declarative intonation, as BP, like NEP, is characterized by rich pitch accent distribution. In Frota & Vigário's (2000) data, 80% of all IP-internal PWs in BP are pitch-accented, and the authors claim, together with Tenani (2002), that the presence of a pitch accent signals a phonological phrase in BP.[13]

This brief description of prosodic and intonational variation within Portuguese has shown that varieties of this language may differ at least in three dimensions of variation: tonal inventory and respective pragmatic meanings of tonal morphemes, prosodic phrasing, and pitch accent distribution. It has also made clear that the sparseness of pitch accents that characterizes standard EP does not only distinguish this language from other Romance languages, but also singles it out relative to other varieties of the same language.

## 5. Summary and conclusion

In this chapter, I have presented an analysis of the prosodic and intonational structure of standard European Portuguese. The properties of the prosodic word, the phonological phrase

[13] Further data inspection is required to determine whether the relevant domain for pitch accent distribution in BP is not even smaller, i.e. the prosodic word, like in Egyptian Arabic (Hellmuth 2007).

and the intonational in this language are summarised in Table 2. The prosodic word is the domain for many segmental and prominence-related phenomena that make the phonology of the PW in EP closer to Germanic than to other Romance languages. Also unlike in many languages, including some of the Romance area, the phonological phrase in EP is not a domain for sandhi, does not show temporal boundary marking and does not have to be tonally marked. The more subtle manifestations of the PhP in the prosody of EP contrast with the properties shown by the intonational phrase, which is the domain for sandhi phenomena, pre-boundary lengthening, tonal boundary marking and pitch accent distribution. The latter property also singles out EP relative to other Romance languages. This property, together with a tendency to long prosodic phrases, yields one of the most salient prosodic features of EP: the sparseness of pitch accents within the intonational phrase.

TABLE 2. EP prosodic structure: properties of the PW, PhP and IP.

| Properties | Segmental | Durational | Tonal | Prominence |
|---|---|---|---|---|
| PW | *Edge phenomena*: phonotactic constraints, many segmental processes<br>*Phenomena targeting the PW*: clipping, deletion under identity | [not studied] | First PW of the IP is the domain for the optional phrasal tone H | Word stress<br>Many segmental processes that refer to presence/absence of word stress (e.g. vowel reduction) |
| PhP | NO | NO | NO | Rightmost (default)<br>PhP heads constrain the output of vowel sandhi<br>*Domain* for stress strengthening |
| IP | *Domain* for many segmental processes<br>*Domain* for resyllabification<br>*Left edge*: reduced forms of proclitics are highly disfavoured | Final lengthening<br>IP-edge: Locus of pauses | *Domain* for pitch accent distribution: IP heads require a pitch accent<br>*Right edge* requires boundary tone<br>*Left edge* optionally marked | Rightmost (default)<br>Focus prominence (not positional) |

The intonation system of the language was shown to consist of pitch accents and edge tones with a peripheral association to intonational phrase edges. The phrase accent category can be dispensed with in the intonational analysis of EP. A system of phonological contrasts between accentual tones, IP boundary tones, and their combinations accounts for all the contours examined, as well as their pragmatic meanings. The morphemic behaviour of the tonal events is clearly exemplified in the way the language expresses focus prosodically. The presence of a narrow/contrastive focus in a sentence does not change the default phrasing patterns, whether at the phonological or intonational phrase levels. However, it does change both the sentence prominence and intonation: in particular, the IP-head under focus prominence bears a special pitch accent that contrasts with the nuclear accent under default or unmarked prominence. Another example of such morphemic status is the use of a particular type of tonal boundary marking to signal interrogation. The way in which the tonal and the segmental strings interact in EP also deserves a comment: the language does not truncate, but it seems not also to compress the tonal string; rather, the segmental string is extended to cope with tonal realization, either by means of vowel lengthening or by vowel epenthesis after a sonorant coda. In the particular case of the vocative chant, not only the vowel split into two vowels may occur, but also phonetic vowel reduction and vowel deletion, common elsewhere, are blocked.

Although the last few decades have seen much progress in the description and understanding of the intonational phonology of European Portuguese, there are still many unresolved issues and challenges for future research. Among the former are the phonetics and phonology of scaling and pitch register, upstep and downstep phenomena included, as well as the occurrence of post-focal accents in utterances other than declaratives. Among the latter, I would like to highlight those that are in my view the three main avenues for future research:

(i) phrasing and intonation across varieties of Portuguese (extending the comparative work that began with Northern EP and BP); (ii) phrasing and intonation across speech styles (together with the design of a set of conventions for labelling Portuguese intonation, as in work in progress within the P-ToBI project – Viana & Frota 2007); and (iii) the acquisition and development of prosodic phrasing and intonation.

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**References**

Arvaniti, Amalia. 1994. Acoustic features of Greek rhythmic structure. *Journal of Phonetics* 22: 239–268.

Arvaniti, Amalia and Mary Baltazani. 2005. Intonational Analysis and Prosodic Annotation of Greek Spoken Corpora. In *Prosodic Typology. The Phonology of Intonation and Phrasing* ed. by Sun-Ah Jun, 84-117. Oxford: Oxford University Press.

Beckman, Mary and Janet Pierrehumbert. 1986. Intonational Structure in Japanese and English. *Phonology Yearbook* 3: 255–310.

Beckman, Mary, Julia Hirschberg and Stefanie Shattuck-Hufnagel. 2005. The Original ToBI System and the Evolution of the ToBI Framework. In *Prosodic Typology. The Phonology of Intonation and Phrasing* ed. by Sun-Ah Jun, 9-54. Oxford: Oxford University Press.

Cruz-Ferreira, Madalena. 1980. Basic intonational and grammatical patterns of Portuguese and English questions. Unpublished MA dissertation, University of Manchester.

Cruz-Ferreira, Madalena. 1998. Intonation in European Portuguese. In *Intonation Systems. A Survey of Twenty Languages,* Daniel Hirst and Albert Di Cristo (eds), 167-178. Cambridge: Cambridge University Press.

Ellison, Mark and M. Céu Viana. 1996. Antagonismo e elisão das vogais átonas em P.E.. *Actas do XI Encontro da Associação Portuguesa de Linguística*, Vol. III, 261–282. Lisboa: APL/Colibri.

Elordieta, Gorka, Sónia Frota and Marina Vigário. 2005. "Subjects, objects and intonational phrasing in Spanish and Portuguese". Studia Linguistica 59:2/3. 110-143.

Falé, Isabel. 1995. Fragmento da Prosódia do Português Europeu: as Estruturas Coordenadas. Unpublished MA dissertation, University of Lisbon.

Falé, Isabel. 2005. Percepção e Reconhecimento da Informação Entoacional em Português Europeu. Unpublished PhD dissertation, University of Lisbon.

Falé, Isabel and Isabel H. Faria. 2006. Categorical Perception of Intonational Contrasts in European Portuguese. *Speech Prosody 2006*. Dresden, Germany, 69-72.

Falé, Isabel and Isabel H. Faria. 2007. Imperatives, orders and requests in European Portuguese intonation. *Proceedings of the 16th International Congress of Phonetic Sciences*, 1041-1044.

Fernandes, Flaviane. 2007. Ordem, Focalização e Preenchimento em Português: Sintaxe e Prosódia. Unpublished PhD dissertation, State University of Campinas.

Frota, Sónia. 1993. On the Prosody of Focus in European Portuguese. *Proceedings of the Workshop on Phonology*, 45–66. Lisboa: APL.

Frota, Sónia. 1996. Prosodic Phrases and European Portuguese: in search of evidence. In Antonietta Bisetti et al. (eds.) *Proceedings of ConSole 3*, 47–69. Leiden: SOLE.

Frota, Sónia. 1997. Association, Alignment, and Meaning: the tonal sequence HL and Focus in European Portuguese. In *Intonation: Theory, Models and Applications—Proceedings of an ESCA Workshop*, Antonis Botinis et al. (eds.), 127–130. Athens: ESCA/University of Athens.

Frota, Sónia. 2000. *Prosody and focus in European Portuguese. Phonological phrasing and intonation.* New York: Garland Publishing.

Frota, Sónia. 2002a. Tonal association and target alignment in European Portuguese nuclear falls. In *Laboratory Phonology 7*, ed. by Carlos Gussenhoven & Natasha Warner, 387-418. Berlin & New York: Mouton de Gruyter.

Frota, Sónia. 2002b. Nuclear falls and rises in European Portuguese: a phonological analysis of declarative and question intonation. *Probus* 14 (Special issue on Intonation in Romance, edited by J. Ignacio Hualde), 113-146.

Frota, Sónia. 2002c. The Prosody of Focus: a Case-Study with Cross-Linguistic Implications. In *Proceedings of Speech Prosody 2002*, Aix en Provence, 319-322.

Frota, Sónia. 2003. The phonological status of initial peaks in European Portuguese. *Catalan Journal of Linguistics* 2, 133-152.

Frota, Sónia and Marina Vigário. 2000. Aspectos de prosódia comparada: ritmo e entoação no PE e no PB. In *Actas do XV Encontro da Associação Portuguesa de Linguística,* Rui V. Castro and Pilar Barbosa (eds), Vol.1, 533-555. Coimbra: APL.

Frota, Sónia and Marina Vigário. 2007. Intonational Phrasing in two varieties of European Portuguese. In *Tones and Tunes*, T. Riad & C. Gussenhoven (eds.). Vol. I, 265-291. Berlin: Mouton de Gruyter.

Frota, Sónia, Mariapaola D'Imperio, Gorka Elordieta, Pilar Prieto and Marina Vigário. 2007. The phonetics and phonology of intonational phrasing in Romance. In *Prosodic and Segmental Issues in (Romance) Phonology*, Pilar Prieto, Joan Mascaró & Maria-Josep Solé (eds), 131-153. Amsterdam/Philadelphia: John Benjamins.

Frota, Sónia, Marina Vigário and Fernando Martins. 2006. FreP: An Electronic Tool for Extracting Frequency Information of Phonological Units from Portuguese Written Text. *Proceedings of the 5th International Conference on Language Resources and Evaluation*, Genoa.

Ghini, Mirco. 1993. ϕ-formation in Italian: a new proposal. *Toronto Working Papers in Linguistics* 12.2, 41–79.

Gordon, Matthew K. 2005. Intonational Phonology of Chickasaw. In *Prosodic Typology. The Phonology of Intonation and Phrasing* ed. by Sun-Ah Jun, 301-330. Oxford: Oxford University Press.

Grice, Martine. 1995. *The intonation of interrogation in Palermo Italian: implications for intonation theory*. Tübingen: Niemeyer.

Grϕnnum, Nina and M. Céu Viana 1999. Aspects of European Portuguese Intonation. *ICPhS 99,* Vol.3, 1997-2000. San Francisco.

Gussenhoven, Carlos. 1993. The Dutch foot and the chanted call. *Journal of Linguistics* 29, 37-63.

Gussenhoven, Carlos. 2004. *The Phonology of Tone and Intonation*. Cambridge: Cambridge University Press.

Hayes, Bruce and Aditi Lahiri. 1991a. Bengali Intonational Phonology. *Natural Language and Linguistic Theory* 9: 47–96.

Hayes, Bruce and Aditi Lahiri. 1991b. Durationally specified intonation in English and Bengali. In *Music, Language, Speech, and Brain*, J. Sundberg, L. Nord and R. Carlson (eds.), 78-91. Basingstoke: Macmillan.

Hellmuth, Sam. 2007. The relationship between prosodic structure and pitch accent distribution: evidence from Egyptian Arabic. *The Linguistic Review* (Special issue on Prosodic Phrasing ed. by Sónia Frota and Pilar Prieto) 24, 291-316.

Jun, Sun-Ah. 1996. *The Phonetics and Phonology of Korean Prosody: Intonational Phonology and Prosodic Structure*. New York: Garland Publishing.

Jun, Sun-Ah. 2005. Korean Intonational Phonology and Prosodic Transcription. In *Prosodic Typology. The Phonology of Intonation and Phrasing* ed. by Sun-Ah Jun, 201-229. Oxford: Oxford University Press.

Ladd, D. Robert. 1996. *Intonational Phonology.* Cambridge: Cambridge University Press.

Mata, Ana I. 1999. Para o estudo da entoação em fala espontânea e preparada no Português Europeu. Unpublished Ph.D. dissertation, University of Lisbon.

Nespor, M. and Irene Vogel. 2007. *Prosodic Phonology*. Berlin/New York: Mouton de Gruyter. (2nd edition).

Peperkamp, Sharon. 1997. *Prosodic Words*. HIL Dissertations 34. The Hague: Holland Academic Graphics.

Prieto, Pilar. 2002. Entonació. In *Gramàtica del català contemporani*, ed. By Joan Solà, Maria Rosa Lloret, Joan Mascaró and Manuel Pérez Saldanya, Volum 1, 393-462. Barcelona: Empúries.

Prieto, Pilar. 2004. *Fonètica i fonologia. Els sons del català*. Barcelona: Editorial UOC.

Prieto, Pilar, Lourdes Aguilar, Ignasi Mascaró, Francesc J. Torres and Maria del Mar Vanrell. 2007. CatToBI. http://seneca.uab.es/atlesentonacio/

Tenani, Luciani. 2002. Domínios prosódicos no Português do brasil: implicações para a prosódia e para a aplicação de processos fonológicos. Unpublished PhD dissertation, State University of Campinas.

Viana, M. Céu. 1987. Para a síntese da entoação do Português. Dissertação para acesso à categoria de Investigador Auxiliar. Lisboa: CLUL-INIC.

Viana, M. Céu and S. Frota. 2007. Towards a P_ToBI. http://www.fl.ul.pt/dlgr/SonseMelodias/P-ToBI/P-ToBI.htm (collaborators: I. Falé, F. Fernandes, I. Marcarenhas, A. I. Mata, H. Moniz & M. Vigário).

Vigário, Marina. 1997. Marcação prosódica em frases negativas no Português Europeu. In *Actas do XII Encontro da Associação Portuguesa de Linguística,* Ivo Castro (ed.), Vol. I., 329-249. Lisboa: APL/Colibri

Vigário, Marina. 1998. *Aspectos da Prosódia do Português Europeu: estruturas com advérbio de exclusão e negação frásica*. Braga: CEHUM.

Vigário, Marina. 2003. *The Prosodic Word in European Portuguese*. Berlin/New York: Mouton de Gruyter.

Vigário, Marina & Sónia Frota. 2003. The intonation of Standard and Northern European Portuguese. *Journal of Portuguese Linguistics* 2-2 (Special Issue on Portuguese Phonology, edited by W. L. Wetzels), 115-137.

Vigário, M. João Freitas and Sónia Frota. 2006. Grammar and frequency effects in the acquisition of prosodic words in European Portuguese. *Language and Speech* (Special Issue Crosslinguistic Perspectives on the Development of Prosodic Words, edited by K. Demuth) 49(2), 175-203.