Nuclear falls and rises in European Portuguese:
a phonological analysis of declarative and question intonation

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Running title: Nuclear falls and rises

Abstract

This paper investigates the tonal structure of nuclear falls and rises in European Portuguese declarative and question intonation. Declarative sentences, wh-questions and yes-no questions are examined. The interaction between utterance type and the expression of broad and narrow focus is also inspected. The alternative phonological analyses for the falling and rising patterns are evaluated in detail. It is shown that a system of phonological contrasts between accentual tones and intonational-phrase boundary tones provides a unified account of all the contours examined. Specifically, the I-boundary tone bears the utterance type distinguishing function (declarative Li vs. interrogative LHi / HLi), while the bitonal nuclear tone carries the focus marker (broad focus H+L* vs. narrow focus H*+L / L*+H). The phrase accent category can be dispensed with. A brief comparison with the role played by accentual and phrase tones in the same tunes of other Romance languages highlights some similarities and differences in the melodic systems within Romance.

1. Introduction

This paper presents a phonological analysis of the falling and rising nuclear contours that characterise declarative and question intonation in European Portuguese (Lisbon variety). Three utterance types are examined: declarative sentences, yes-no questions and wh-questions. In addition, the interaction between utterance type and the expression of broad and narrow focus is inspected. This allows four comparisons to be made between the nuclear patterns of declaratives and (yes-no) questions, both broad focused and narrow focused.

The analytical framework followed here 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 1991, Avesani 1995, 1999, Grice 1995, Prieto 1995, 1999, Prieto, van Santen & Hirschberg 1995, Jun 1996, Ladd 1996, D'Imperio 1997, 1999, Hirschberg & Avesani 1997, Sosa 1999, Arvaniti, Ladd & Mennen 2000, Grice, Ladd & Arvaniti 2000, Gussenhoven 2000, Hualde 2000, Post 2000, among others). Under this approach, the intonation contour is formed by a string of tones. In languages like English and European Portuguese, the events of the tonal string are either pitch accents (T*) or phrase tones, which may be simple (i.e. monotonal) or complex (i.e. bitonal). The former are tonal events associated with prominent elements in the segmental string. The latter are tonal events linked to phrase-level prosodic domains. Phrase tones comprise two categories, boundary tones and phrase accents (respectively, T% and T⁻ in Pierrehumbert's notation). Between the local tonal events, the intonation contour is phonologically unspecified.

Work on European Portuguese intonation couched within the auto-segmental metrical theory is fairly recent (see Frota 2000a: section 1.5 for an overview). After the pioneering work of Viana (1987), during the last decade authors have concentrated mostly on the description of declarative intonation (Frota 1993, 1997a, 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, has only emerged in the last years (Frota 1997b, 2000a,b, Grønnum & Viana 1999). In the present paper, a description of the main characteristics of European Portuguese declarative and question intonation is offered (respectively, in sections 2 and 3). The phonological analysis of the falling and rising nuclear contours put forward bears on the current controversy around the organisation of the tones that make up such contours into accentual tonal categories (i.e. single-tone or bitonal pitch accents) and phrase tones (i.e. phrasal accent and/or boundary tones) (see, among others, Grice et al. 2000 and Frota 2000b). In section 4, the comparison between broad and narrow focused declarative and interrogative contours is shown to shed new light on the intonation signalling of focus and the nature of the interrogative tonal marker in European Portuguese. Section 5 outlines the major features of the nuclear contours analysed.

2. Declarative intonation

The description of declarative intonation given in this section is based on data in Frota (1993, 1997a, 2000a,b). Data from other studies of the intonation of declaratives by

different authors is also considered for comparison purposes. In either case, the corpora observed consist of read speech materials collected under laboratory conditions.

2.1. Neutral declarative contour

There are two indisputable facts that come out of the literature on European Portuguese (EP) declarative intonation: first, the declarative contour consists of an initial rise and a sharp final fall, between which there is a plateau; secondly, the falling movement occurs in the last stressed syllable of the intonational phrase (Delgado Martins & Lacerda 1977, Martins 1986, Viana 1987, Frota 1991, 1993, Falé 1995, Vigário 1998, Grønnum & Viana 1999, Mata 1999). Both the sparseness of tonal events and the nuclear fall that characterise neutral declaratives are illustrated in Figures 1-2 (panel A).

FIGURES 1 & 2 about here

This contour is typical of sentences uttered out-of-the-blue or in response to 'what-happened' questions, that is sentences with a broad focus reading. In addition, the same type of nuclear fall has also been found as a possible pitch contour of topicalised phrases (*in situ* or dislocated phrases that express what the sentence is about - Frota 2000a).

The coincident phonetic descriptions across authors are reflected in the general assumption that the standard declarative contour consists of an initial H tone, realised in the vicinity of the first stressed syllable, and a final HL sequence, in which the L is

attained in the last stressed vowel, as shown in (1) (see also Figure 1A). The stretch of the contour intermediate between the initial peak and the final fall is usually accentless, albeit containing several lexical words (in all the examples, stressed syllables are shown in capitals; the nuclear accented syllable is underlined; intonational phrasing is indicated).[1]

(1)   [O pinTOR retraTOU uma maNHÃ ÂMbar]I
                        | |
                  H   H L
       the artist   painted   a   morning amber
       'The artist painted an amber morning.'

Before examining the phonological characterisation of the nuclear fall, a clarifying remark is needed regarding the nature of the prenuclear H plateau. Two analyses have been proposed in the literature for the prenuclear plateau: the spreading account, according to which the initial H tone spreads up to the syllable bearing the following tone (Gr∅nnum & Viana 1999); and the interpolation account, whereby the plateau is the result of a straight-line transition between two H targets (Frota 1993, 2000a,b). Although the plateau would potentially be also consistent with the placement of H* pitch accents on the intonational phrase (I)-medial lexical items, such an analysis has never been proposed. In fact, native speakers do not perceive the medial items as accented in the standard declarative contour. It should be further noticed that a declarative contour with prenuclear accents, besides the initial H, is also possible in European Portuguese (though much less frequent in the data). In the latter case, the relevant medial words are felt as accented and the pitch contour shows a staircase effect that can be analysed by means of a H+!H* accent (as in Ladd 1996, or Beckman & Ayers-Elam 1997, for similar contours in English). Crucially, the prenuclear contour of EP declaratives does not show the iterative high-low pattern so commonly described for Spanish and also found in Brazilian Portuguese (e.g. Prieto et

al. 1995 and Sosa 1999 for different varieties of Spanish; Morais 1998 and Frota &
Vigário 2000 for Brazilian Portuguese).[2]

As to the declarative nuclear fall, it seems clear that a HL melody is involved,
as mentioned above. Due to the consistent alignment of the low with the nuclear
syllable and the fact that the peak typically occurs within the prenuclear syllable, as
illustrated in Figures 1-2A, the nuclear fall is best analysed as including a starred low
tone.[3] The falling movement, however, may be captured either by means of separate
tonal events or, alternatively, by means of a bitonal accent of the H+L* type. In
addition, the nuclear fall may also comprise edge-related tones of the L type. These
two issues are addressed in the following paragraphs.

If the falling movement is conceived as a transition between two independent
targets, there are two possible alternatives: (i) the preaccentual peak is explained by a
preceding accent via spreading, as in (2a); (ii) the preaccentual peak is a word (ω) or
phrasal (ϕ) left-edge tone that precedes a monotonal L* accent, as in (2b).

(2)   a. … σ ˈσ σ … σ ˈσ σ
              | ⟋ |
              L*H   L*

         b.   [[σ ˈσ σ]ω …]ϕ
                  | |
                  H   L*

Hypothesis (2a) is naturally intertwined with the spreading account of the
prenuclear plateau described above. This hypothesis can be straightforwardly
dismissed on the basis of the occurrence of the neutral HL melody in one-word
intonational phrases, that is in strings where the only accentable syllable is the nuclear
one. Figure 2A shows one of such cases.

If the peak were an edge tone as hypothesised in (2b), its location in the prenuclear string relative to the nuclear syllable should vary as a function of the distance of this syllable from the relevant prosodic edge. However, we have shown in previous work that this prediction is contrary to fact (Frota 2000a,b). The examples in (3), based on a set of f_0 contours from Frota (2000a), illustrate the alignment of the peak just before the nuclear accented syllable and never before the prenuclear syllable, irrespective of the distance from the left-edge of the prosodic word or phonological phrase.

(3)   a. [... [à MaRIa]ϕ]I   '…to Mary'

              H L*

     b. [... [aos jornaLIStas]ϕ]I   '…to the journalists'

                H L*

     c. [... [uma maNHÃ ÂMbar]ϕ]I   '… an amber morning'

                H L*   (from Frota 2000a:280)

Contrary to the alternatives in (2) above, the bitonal analysis of the neutral fall provides a clear-cut account of the data. As expected from a leading H tone of a bitonal H+L* accent, the peak closely precedes the low in all cases.

We will now examine the hypothesis that the neutral fall may include edge-related tones of the L type. Although the presence of an additional L target, after the accentual low, is not always phonetically transparent in utterance-final position, there are both phonological as well as phonetic reasons for postulating a final boundary tone in the declarative tune.

Utterance non-final I-phrases, like initial topics or non-final parenthetical expressions, are obligatorily marked by a right-edge tone, which may be either of the H or the L type (Vigário 1998, Frota 2000a:chap.5). The case of leftward topicalised phrases bearing a H+L* nuclear pitch accent is instructive in this regard. As shown in

example (4), where the phrase [as angolanas] is uttered as a topic, there is evidence for two L targets: the pitch fall from the pre-accentual peak to L* is followed by an additional descent into the bottom of the speaking range. Such a fall is usually taken to be the result of L%, that is of a I-final low boundary tone (e.g. Ladd 1996:87-88; I-boundary tones will be hereafter notated as Ti, following Hayes & Lahiri 1991).

(4)   a. [As angoLAnas]I [ofereCEram especiaRIas aos jornaLIStas]I
               HL* L1   L2
         the Angolans-FEM   offered   spices to-the journalists-MAS
         'As for the Angolans, (they) offered spices to the journalists'

       b.   H   L*   L1   L2

                   LA   _ _ _ _   (Adapted from Frota 2000a:263-264)

A second argument for Li in the declarative fall is provided by Vigário's (1997) account of register shifts in EP. Vigário has convincingly shown that when the final HL melody is uttered in a raised register (mainly for emphasis purposes) the boundary tone is realised in the unmarked register, and thus the contour draws a clear pitch drop between the accentual L and the boundary Li tone. Thirdly, the intonation of yes-no questions in EP is known to include a final rise at the very end of the pitch contour that contrasts paradigmatically with the final low pitch found in declaratives (Viana 1987). An obvious way to express this contrast, first suggested in Vigário 1998, is assuming a Hi for questions and a Li for declaratives (we will return to this point in section 3 below).

Besides supporting an analysis of the nuclear fall that includes Li, the arguments enumerated above also suggest a straightforward reason for why Li is not *always* phonetically transparent: unlike in non-final phrases or in final phrases with raised register, in (unmarked) utterance-final phrases the bottom of the speaking range may be reached at the accentual L leaving no room for a posterior pitch descent.

As to a possible low phrase accent in the declarative fall, the data described so far in the literature provides no clear evidence for it. It is not only the absence of a further post-accentual low target, which could appear in sequences where the nuclear word is a proparoxytone (e.g. *arqueóloga* 'archaeologist', *LÂminas* 'blades'), that argues against L⁻. The fact that, to the best of our knowledge, the nuclear configurations of EP have been analysed without resorting to the phrase accent category is a sign that the phrase accent unit may be dispensed with in this language (similarly to proposals for other Romance languages, e.g. Sosa 1999 for Spanish and Post 2000 for French). The phrase accent issue will be further discussed in the following sections on the declarative focus contour and the interrogative contours.

In conclusion, the rough tonal depiction of the standard declarative contour given in (1) above (see also Figure 1A) should be reformulated by as shown in (5), whereby the defining elements of the declarative tune are the nuclear accent H+L* and the boundary tone Li.

(5)　　[O pinTOR retraTOU uma maNHÃ ÂMbar]I
　　　　　　|　　　　　　　　　　　|　　|
　　　　　H*　　　　　　　　H+L*　Li
　　　'The artist painted an amber morning.'

2.2. Intonational signalling of focus

The neutral declarative contour can be compared with the contours of sentences in which a particular constituent is focalised, and thus the broad focus reading is lost in favour of a narrow/contrastive focus reading. Although the literature on focus intonation is much more limited than that on its neutral counterpart, there are two salient properties in the available descriptions: first, a falling pitch movement is present in the vicinity of the stressed syllable of the focalised word, regardless of its

position in the intonational (I) phrase; secondly, if the focalised word is located early in the I-phrase, a post-focal fall of narrow range occurs in the I-final stressed syllable (Frota 1997a, 2000a, and Vigário 1998). Figures 1-2 (panel B) and Figure 3B illustrate these properties.

FIGURE 3 about here

The focus nuclear fall looks different from the neutral one. It is clear that the two falling contours differ in the location of the peak relative to the nuclear syllable, as shown by the contrast between the neutral contour in Fig.2A and the focus contour in Fig.2B above.[4] This difference is depicted in (6), where the box indicates the domain of the nuclear syllable.

(6) a. Neutral contour   Focus contour
    b.

        H   L   H   L
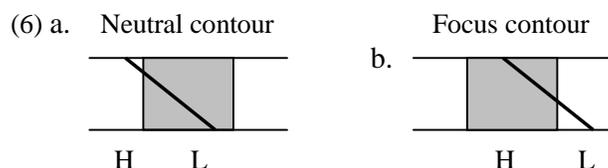
It should be further noticed that the realisation of the peak within the nuclear syllable in the focus contour is independent of the final or early position of the intonational nucleus, as Fig. 3B illustrates. The fact that, unlike in the neutral fall, in the focus fall the peak is aligned with the nuclear syllable supports an analysis of the focus nucleus as including a H* tone. The phonological status of the following L target, however, is not so obvious. Although the earlier descriptions (Frota 1997a, 2000a, Vigário 1998) have all assumed a bitonal pitch accent (H*+L), this proposal has to be confronted with two alternative accounts that treat the falling movement as a transition between independent tonal events: (i) a monotonal H* accent and a boundary L tone, like in the focus tune of Bengali (Hayes & Lahiri 1991); (ii) a monotonal H* accent and a

phrase accent of the L type, as it has been proposed for the focus fall in Standard Italian (Avesani 1999).

The competing analyses of the focus fall have been examined in previous work (Frota 2000a,b). If the low were a phonological phrase (φ) boundary tone or a prosodic word (ω) boundary tone, the alignment of the L target should be affected by the distance to the relevant prosodic edge. Our data, however, show that proximity to the nuclear syllable clearly preponderates over proximity to the following prosodic boundary, as indicated in (7) (the focused constituent is signalled in bold in all the examples). The examples in (7) are based on a set of contours from Frota (2000a). Illustrative f_0 contours of the sequences in (7a) are shown in Figure 4.

(7)   a. ω and φ-boundary   b. φ-boundary
           i. **o gaLÃ**] ANda…   i. [uma **maNHÃ** ÂMbar]φ
                   | |
                 H* L   H* L
              'the hero drives…'   'an amber morning'
           ii. **as angoLAnas**] ofereCEram…   ii. [uma **maNHÃ** ang(e)liCAL]φ
                   | |
                 H* L   H* L
              'the Angolans gave…'   'an angelic morning'
           iii. … **às arQUEÓlogas**]   iii. [**caFÉ** lusiTAno]φ
                   | |
                 H* L   H* L
           '…to the archaeologists.'   'Lusitanian coffee'
                            (from Frota 2000a:282, 241,135, 299, respectively)

FIGURE 4 about here

The phrase accent alternative is also not supported by the data. The composite set of alignment effects predicted by the phrase accent analysis has been inspected in Frota (2000b). If the phrase accent is simply characterised by a phonological edge affiliation (as in Cypriot Greek question intonation - Grice at al. 2000), the kind of effect expected would be the same as that described for the boundary tone analysis,

which we have already seen not to hold. If the phrase accent combines the former property with a secondary association to a stressed syllable (as in German nuclear falls - Benzmüller & Grice 1998), then the alignment of the L should be affected by the distance to a following word stress. That is, however, not the case. In examples like those in (8), with a varying interstress interval (the number of syllables is indicated), the location of the low is always dependent on the location of the peak and coincides in most cases with the postnuclear syllable.

(8)   a. uma **maNHÃ** ÂMbar (0 σ) / uma **maNHÃ** ang(e)liCAL (2 σ)
                    | |
                  H* L   H* L
           'an amber morning'   'an angelic morning'
        b. **o gaLÃ** ANda… (0 σ)   / **o gaLÃ** anDAva… (1 σ)
                    | |
                  H* L   H* L
           'the hero drives…'   'the hero drove…'
        c. **as angoLAnas** of(e)reCEram (3 σ)
                    |
                  H* L
           'the Angolans gave…'

The tight timing relationship that characterises the peak and the low in the focus fall is consistent with a third version of the phrase accent analysis: the possibility that the phrase accent may show a secondary association not to a postnuclear stressed syllable but to the nuclear accented syllable (as in English nuclear falls - Grice et al. 2000). Nevertheless, this account must be rejected for both phonological and phonetic reasons. If phrase accents are defined as final in a phrase like in English or German, that is they follow the last pitch accent within their phrase (Beckman & Pierrehumbert 1986), the L target of EP cannot be a phrase accent. In EP, an early focus fall may be followed by a post-focal accent in the last stressed syllable of the phrase, as mentioned before and illustrated by Fig.3B (the post-focal accent issue will be further pursued below). As the focus fall is not always phrase-final, the low cannot be

explained by a phrase accent that has a secondary association to the nuclear syllable across the last accented syllable of the same phrase.[5]

Consequently, both the boundary tone and the phrase accent accounts of the focus nuclear fall should be rejected. Only the bitonal analysis, according to which the low is a trailing tone of a H*+L accent, is supported by the facts of EP. The phonological representation of the focus fall in this language is given in (9).

(9)   Focus nuclear fall
         [… [… ˈσ …]ω …]I
                  |
               H*+L
         e.g. [… [… **maNHÃ**]ω ÂMbar]I (Fig.1B),   [[ca**SA**ram]ω]I (Fig.2B)
                           | |
                        H*+L   H*+L
                  'amber morning'   'they got married'

We will conclude our description of the intonation of focus in declarative sentences with a remark on the nature of the postnuclear contour (see also Frota 2000:5.3.3). Unlike the neutral fall, which is always final in the I-phrase as the last stressed syllable bears the nuclear accent, the focus fall may be final or early in the I-phrase depending on the position of the focalised element (examples of either case have already been mentioned in this section). If the syllable bearing the focus nuclear fall is neither the last stressed syllable of the I-phrase (as in Fig.2B), nor adjacent to the last stressed syllable (as in Fig.1B), a post-focal fall occurs in the I-final stressed syllable (as in Fig.3B). The fact that the postnuclear fall coincides with the last stressed syllable irrespective of the presence or absence of ensuing unstressed syllables, as shown by the alignment patterns of the illustrative examples in (10), argues in favour of its accentual status.

(10)   a. O pintor cantou uma **maNHÃ** angeliCAL
                                         H L
            'The artist sang an angelic morning'

b. Também vendo **caFÉ** lusiTAno
                              H L
    'I also sell Lusitanian coffee'   (from Frota 2000a:298-299)

Additionally, a comparison between the post-focal fall and the neutral nuclear fall shows that the two events are not aligned differently with respect to the I-final stressed syllable (see (10) versus (3) above). The difference resides instead in the comparatively narrow range of the post-focal fall, well patent in Fig.3, which is not an uncommon phenomenon cross-linguistically (languages such as Danish, Mandarin Chinese, or Bari, Neapolitan and Palermo Italian are among those reported to reduce, and not deaccent, post-focal material - see, respectively, Grønnum 1992, Jin 1996, Grice & Savino 1997, D'Imperio 1997, and Grice 1995). The postnuclear fall can thus be analysed as a H+L* accent. Similarly to early focus utterances in Palermo Italian (Grice 1995), the postnuclear accent in EP is the neutral accent.

      A complete analysis of the focus declarative contour in Fig.3B is given in (11).

(11)   [O pinTOR canTOU uma **maNHÃ** angeliCAL]I
          | | | |
        H*   H*+L H+L*Li
     the artist sang   a   morning angelic
    'The artist sang an angelic **morning**'

In European Portuguese declaratives, focus is intonationally signalled by a pitch accent that contrasts with the neutral nuclear accent.

2.3. Summary: phonological analysis of declarative nuclear accents

The analysis of the falling nuclear contours that characterise declarative intonation in European Portuguese just presented involves a HL melody in both the neutral and the focus contours. The two contours, however, differ crucially with respect to their

phonological organisation: the neutral fall includes a starred low tone and a leading H tone, while the focus fall includes a starred high tone and a trailing L tone. An overview of the declarative nuclear accents is given in Table I. Analogous timing contrasts have been found in other languages and have similarly been argued to express different lexical or semantic-discourse meanings (e.g. HL contrast in Swedish word accents, Bruce 1977; LH contrast in English, Pierrehumbert & Steele 1989; LH/HL contrasts in Neapolitan Italian, D'Imperio & House 1997, D'Imperio 1999; accent-lending falls in Dutch, Caspers 1999).

Table I about here

3. Question intonation

The intonation of questions in EP is yet largely unstudied. The only two phonological analyses of the question contours we know of (Cruz-Ferreira 1980, 1998 and Viana 1987) both stress the following differences between declaratives and questions on the one hand, and wh-questions and yes-no questions on the other: (i) the prenuclear contour of questions tends to show an overall higher pitch than its declarative counterpart; (ii) unlike declaratives, questions, and yes-no interrogatives in particular, are characterised by a final rising contour; (iii) in wh-question intonation, the final rise usually gives way to a final fall. The final two issues, which crucially bear on the account of nuclear contours, are addressed in the present paper.

Cruz-Ferreira's analysis, which has been developed within the British school framework, is sketched in (11). A correspondence with an auto-segmental analysis, following the table of correspondences proposed in Ladd (1996), is also given.

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(11)   Cruz-Ferreira (1980, 1998)
        Utterance type   *Nuclear tone*   *Auto-segmental taxonomy*
        Declarative   low-fall   H+L* L Li
        Wh-question   low-fall   H+L* L Li
        'Polite' wh-question   low-rise   L*+H H Hi or H+L* H Hi
        Yes-no question   low-rise   L*+H H Hi or H+L* H Hi

According to Cruz-Ferreira, wh-questions usually share with declaratives the same nuclear tone, contrary to yes-no questions. However, in auto-segmental terms the possibility that the three utterance types may show the *same* nuclear accent and an edge tone contrast cannot be dismissed without further inspection.

The analysis proposed in Viana (1987), which is developed within the auto-segmental phonology framework, also groups together the declarative and wh-question melodies against the yes-no question tune. The essentials of Viana's proposal are sketched in (12).

(12)   Viana (1987)
        Utterance type   Melody   Example [σ σ ˈσ σ]   [σ σ ˈσ σ]
        Declarative   HL
        Wh-question   HL   H L
        Yes-no question   HLH   H L H
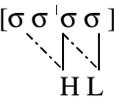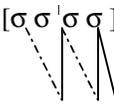
Although the phonological organisation of the tones that make up the different contours is not dealt with in Viana's work, the edge-related nature of the final H in the yes-no question melody emerges from both the phonetic description and the phonological analysis: the final rise occurs always at the very end of the pitch contour. Again, the hypothesis that the three utterance types share the same nuclear accent has to be raised. This hypothesis is discussed in sections 3.1. and 3.2. Section 3.3 is devoted to the intonation of focus in yes-no questions, which has remained unstudied in former work. The description of question intonation given in the following sections is based on read speech data collected under laboratory conditions. Over 130 questions have been uttered by three speakers, two of which were among

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the speakers that produced the declarative data. The two sets of data should thus be regarded as comparable.

3.1. Wh-question contour

As already noticed by Cruz-Ferreira and Viana, wh-question intonation is very similar to neutral declarative intonation. This similarity is illustrated by the contour in Figure 5, which can be compared with the declarative contour in Fig.1A. 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 intonational phrase.

FIGURE 5 about here

The parallelism between the two contours should be reflected by a phonological analysis that captures both the sparseness of tonal events in the prenuclear stretch and the nature of the nuclear fall. An obvious way to express this parallelism is by proposing the same analysis for the two contours. The wh-question tune in Fig.5 is thus analysed as in (14), just like the declarative tune in Fig.1A whose analysis was given in (5) above.

(14)   [QUEM pinTOU uma maNHÃ ÂMbar]I
          | | |
          H*   H+L* Li
        'Who painted an amber morning?'

In this respect, EP behaves like other Romance languages, such as Spanish or Standard Italian, in which the two contours have also been described as parallel (e.g. Sosa 1999 and Avesani 1995, respectively).

In the data from one of the speakers, a final rise is *added* to the nuclear fall when the last word shows penultimate stress and the posttonic vowel is phonetically realised. The presence/absence of the final rise, here notated as H, is illustrated in (15) (the parentheses indicate that the vowel is not present in the phonetic string).

(15)   a.

       QUEM canTOU uma maNHÃ ang(e)li<u>CAL</u> ?   'Who sang an angelic morning?'
                                      H+L*

    b.

       QUEM ANda de <u>POR</u>sch(e) ?   'Who drives a Porsche?'
                H+L*

    c.

       QUEM pinTOU uma maNHÃ <u>ÂM</u>bar ?   'Who painted an amber morning?'
                         H+L* H
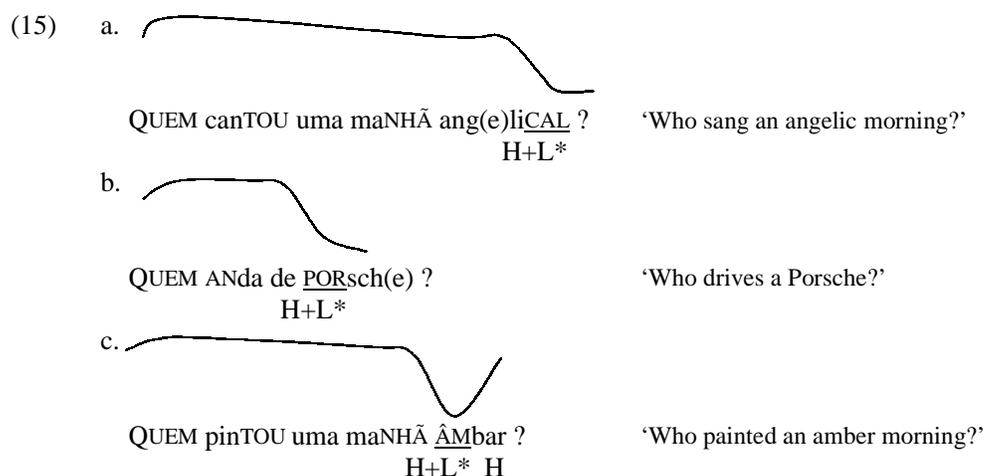
This realisation of the wh-question contour is reminiscent of the "polite" wh-questions described by Cruz-Ferreira. The final rise is optional in the sense that it is not required as a basic element of a wh-question contour. However, in our data the presence of the final rise is clearly conditioned by the availability of segmental material after the last stress. The discussion of the precise phonological status of the final rise is pursued in the following section.

3.2. Yes-no question contour

As expected on the basis of previous descriptions, yes-no question intonation is characterised by an obligatory final rise. The shape of the remnant contour, however, looks very similar to the declarative or the wh-question tunes: the prenuclear contour is typically formed by a high plateau, and the last stressed syllable shows a falling

movement. Both the similarity and the difference are illustrated by the contours in Figure 6. This section concentrates on the phonological characterisation of the final fall-rise of the yes-no question tune.

FIGURE 6 about here

On the basis of the contour in Fig.6, panel A, it appears that a complex HLH tonal sequence is realised within the last stressed syllable of the I-phrase. The nature of the final fall-rise, however, becomes clearer once the contours in panels B and C are also considered. Here the final fall-rise can be seen to consist of a sequence of at least two discrete events, a fall through the last stressed syllable and a steep rise in the very last syllable of the I-phrase. In other words, the final fall-rise comprises an accentual feature (the fall) and an edge-related feature (the rise). As to the former, it is characterised by the same timing properties that were shown to define the nuclear accent of neutral declaratives and wh-questions (sections 2.1 and 3.1, respectively): the low aligns with the nuclear syllable and the peak occurs just before the nuclear syllable, irrespective of the number of pre-tonic syllables in the nuclear word and the distance from a prosodic edge. This is shown by the examples in (16), which depict the patterns of tonal alignment found in Fig.6.

(16)   a. [O POEta canTOU [uma maNHÃ angeliCAL]ɸ]I
                                          |
                                   H L H
        the poet sang   a morning angelic
        'Did the poet sing an angelic morning?'
      b. [Os raPAzes [comPRAram LÂminas]ɸ]I
                              |
                             H L   H
        the boys   bought   slides
        'Did the boys buy slides (for the microscope)?'

c. [As meNInas angoLAnas [LEram-no-la]φ]I
                          |
                    H   L   H
   the girls   Angolans-FEM read-CL-CL
   'Did the Angolan girls read it to us?'

We are thus led to conclude that H+L* is the nuclear pitch accent of neutral yes-no questions in EP. It should be recalled that this was one of the possible accents in the auto-segmental description of the "low-rise" proposed in Cruz-Ferreira's work. This analysis is also consistent with the HL melody of Viana (1987), once the final H is subtracted as an independent event. In short, not only neutral declaratives and wh-questions, but also yes-no questions show a nuclear bitonal accent of the H+L* type. As to the final rise typical of yes-no questions, its analysis is not as straightforward.

In sequences ending in words with final stress (like in Fig.6A) or words with penultimate stress, there is apparently one H target at the very end of the contour and the pitch rises from the accentual L up to the boundary H. In the first case, the rise is realised within the final stressed syllable, and in the second case it is the final posttonic syllable that shows a rising contour. This is illustrated in (17).

(17)   a. [Ela foi ver o MAR]I   b. [Ela foi ver a maRIna]I

                  __/   __/

            H+L* H   H+L* H
       she went see the sea   she went see the marina
       'Has she gone to see the sea?'   'Has she gone to see the marina?'

However, the presence of additional segmental material between the last stress and the I-phrase boundary provides evidence for an *intermediate* L target. As can be seen in Fig.6B, the pitch contour is not rising from the offset of the nuclear syllable up to the final syllable. Instead, there is a low plateau in the first posttonic syllable of *LÂminas* and a rise in the final syllable. The pitch excursion that characterises the right edge of the yes-no question contour can thus be analysed as the result of a sequence of edge-related tones of the L H type. Interestingly, nuclear words with final or

penultimate stress (as in (17) above) provide further evidence for the presence of two edge-related tones. In cases like (17a) or (16a), but not (16b-c), the nuclear vowel may show extended lengthening, which yields the perceptual effect of the presence of *two* vowels (see 18a). Alternatively, a final vowel ([ɨ]) may be inserted in the string, thus making the stressed syllable non-final (see 18b). A third piece of evidence comes from nuclear words with a posttonic [ɨ] vowel, as in (18c). Unlike in declaratives or wh-questions where the vowel is not realised, in yes-no questions this vowel is frequently not deleted from the string. In fact, this is to our knowledge the only attested context where word(and phrase)-final [ɨ] is realised as such in the variety of EP studied (on [ɨ] deletion, see Mateus & Delgado Martins 1982 and Vigário 2001).

(18)   a. [Ela foi ver o M[a a]R]I   'Has she gone to see the sea?'
                           |
                    H +L*LH
        b. [Ela foi ver o MA r[ɨ]]I   'Has she gone to see the sea?'
                           |
                    H +L*LH
        c. [O galã anda de PORsch[ɨ]]I   'The hero drives a Porsche?'
                           |
                     H+L*   LH

What the examples in (18) illustrate are different strategies of ensuring enough segmental material for tonal realisation. This behaviour unique to yes-no questions can be explained if a sequence of two edge-related tones has to be realised in the question contour. The strategies in (18) ensure that all the tones are realised and that no more than two tones are realised on a single syllable. On the one hand, EP avoids compression of the contour by complying with the most common limit across-languages of two tones by syllable (cf. Ladd 1996:132-136). On the other hand, EP also avoids truncation of the final rise characteristic of yes-no questions by extending the phonetic string.

What is the precise phonological status of the L and H tones involved in the yes-no question final rise? Due to the external nature of H in the right periphery of the contour, it seems clear that it is a boundary tone marking the right-edge of the I-phrase (Hi). As to the L tone that immediately precedes Hi, there are two alternative analyses: it can either be a low phrase accent, similarly to proposals for the yes-no question tunes of Palermo and Standard Italian (respectively, Grice 1995 and Avesani 1995), or an element of a bitonal boundary tone, as in proposals for the yes-no question contour of Bengali or Roermond Dutch (Hayes & Lahiri 1991 and Gussenhoven 2000, respectively).

Typically, phrase accents are defined as final in their phrase and they control the pitch trajectory between the nuclear accent and the right edge of the phrase (e.g. Pierrehumbert 1980, Beckman & Pierrehumbert 1986, Ladd 1996). In other words, they spread leftwards yielding a stretch of low pitch in the case of L⁻, or a high plateau in the case of H⁻. The observation of examples such as Fig.6B suggests the presence of a low stretch between the accentual L* and the edge-related L tone. This is as expected according to the phrase accent analysis. The same analysis predicts that the low pitch can span several syllables. The inspection of examples such as that in Fig.6C, however, shows that this prediction is not borne out. When several syllables intervene between the nuclear syllable and the boundary syllable, as in *LEram-no-la*, there is no low plateau but a slightly ascending contour up to the final syllable, which bears a rapid pitch rise. This behaviour is more in line with the bitonal boundary tone analysis (LHi): the entire pitch excursion is placed on the final syllable, and the pitch between the nuclear accent and the boundary is not controlled by L but results instead from the interpolation between the accentual and the boundary tones (similarly to the pitch contours found in Bengali).[6] In this view, the low flat pitch that appears when

few segmental material intervenes between the accentual and boundary events (e.g. Fig.6B) and the ascending pitch that emerges when the boundary is farther away from the accent (e.g. Fig.6C) are phonetic variants of tonal target implementation conditioned by the length of the segmental string. Additional arguments in favour of the bitonal boundary analysis will be provided by contours of narrow focused questions discussed in section 3.3.

The proposed phonological representation of the final fall-rise characteristic of the yes-no question tune in EP is given in (19).

(19)   Yes-no question fall-rising nucleus
          [… [… [… ˈσ …]ω]ɸ]I
                        | |
                   H+L*   LHi

The yes-no question contour in Fig.6B should thus be analysed as in (20).

(20)   [Os raPAzes comPRAram LÂminas]I
                    | | |
                  H*   H+L*   LHi
               the boys   bought   slides
             'Did the boys buy slides (for the microscope)?'

3.3. Focus in yes-no questions

The neutral yes-no question contour described above contrasts sharply with the contours of interrogatives in which a particular constituent is focalised. Narrow focused yes-no questions are illustrated in Figure 7: panel A shows an interrogative with late focus on *LÂminas* 'slides', whereas panels B-C show two early focus cases on *maNHÃ* 'morning' and *gaLÃ* 'hero', respectively.[7]

FIGURE 7 about here

The focused question in Fig.7A can be compared with its neutral counterpart in Fig.6B above; likewise, the focused question in Fig.7B has its neutral counterpart in Fig.6A. There are two salient differences that set the focused and the neutral contours apart: (i) in the focused question, the nuclear syllable bears a low-rising pitch and not a falling pitch as in the neutral question; (ii) focused questions show either a final fall or a final rise, whereas the final rise is an obligatory feature of neutral questions. This section is devoted to the examination of these two differences.

The low-rising pitch of the nuclear accented syllable shows the following systematic property that can be seen in all the contours in Fig.7: the pitch is low during a good portion of the nuclear syllable and then rises into the next syllable. This is precisely the common description ascribed to the L*+H pitch accent in other languages (e.g. Ladd 1996). It is important to note that the postnuclear syllable is characterised by high pitch whether the nuclear word is final or non-final in the φ or I-phrase and irrespective of the number of posttonic syllables available, thus supporting the trailing tone status of the H target. The alignment patterns of the L and H targets found in Fig.7 are depicted in (21).

(21)   a. [Os raPAzes [comPRAram **LÂminas**]φ]I
                                  |
                                 L H
            the boys   bought   slides
            'Did the boys buy **slides** (for the microscope)?'
        b. [O POEta canTOU [uma **maNHÃ** angeliCAL]φ]I
                                  |
                                 L H
            the poet sang   a morning angelic
            'Did the poet sing an angelic **morning**?'
        c. [[O ga**LÃ**]φ ANda de PORche]I
                  |
                 L   H
            the hero   drives a Porsche
            'Does **the hero** drive a Porsche?'

We therefore propose to analyse the focus question low-rise by means of the L*+H bitonal accent.

As mentioned above, the L*+H nuclear accent may be followed by a final fall or a final rise. The presence of one or the other of the peripheral contours, however, is not arbitrary: if the nuclear word is phrase-final, a fall marks the right periphery; if the nuclear word is non-final, the right phrase-edge is marked by a rise. Let us consider the latter case first.

In section 3.1, it was seen that a final rise characterises neutral yes-no questions. This rising contour was analysed as comprising a LH sequence that forms a bitonal I-boundary tone. The final rising contours in Fig.6B-C are similar to those previously found in the neutral questions (see Fig.6): the steep rise is placed on the final syllable, and the pitch intermediate between the nuclear accent and the boundary H is clearly not controlled by the L tone. In Fig.7B, there is a gradual fall between the trailing H tone of the nuclear accent and the boundary L tone; in Fig.7C, there is also a falling contour. Noteworthy, neither the post-focal contour in panel B nor the post-focal contour in panel C can be accounted for by the typical behaviour ascribed to a low phrase accent. Due to the similarity between the final rising contours of both neutral and narrow focused yes-no questions, these facts provide additional support for the LHi analysis of final rises.

The post-focal contour in Fig.7C requires a further comment. In this case, there is no gradual fall between the nuclear accent and the I-boundary, but a high plateau followed by a falling contour within the last stressed syllable. This contour is straightforwardly accounted for if, like in the early focus declaratives (see section 2.2), a postnuclear accent may also be present in early focus interrogatives. As in the declarative post-focal contour, the postnuclear accent is the neutral accent H+L*.[8] The phonological analysis of the contour in Fig.6C is given in (22).

(22)   [[**O ga<u>LÃ</u>**]φ ANda d(e) P[ɔ ɔ]Rsch(e)]I
              | | |
           L* + H   H + L*   LHi
        'Does **the hero** drive a Porsche?'

In allowing for a post-focal accent both in early focus declaratives and yes-no questions, EP behaves similarly to Palermo Italian (Grice 1995) and differently from Neapolitan Italian, where a post-focal accent only occurs in yes-no questions, or from Standard Italian, where post-focal accents do not occur either in early focus declaratives or questions (D' Imperio 1997).

As to the final fall that signals the late focused yes-no question contour in EP, it can be the result of either a low boundary tone or a bitonal HL boundary tone. In the first analysis, the late focus question contour will be indistinct from the declarative one, as far as the tonal boundary marking is concerned. In the second analysis, all yes-no question contours will be characterised by a bitonal boundary tone, thus contrasting with the declarative single-tone Li. The contour in Fig.7A looks amenable to either of the analyses: the rising pitch reaches its end in the first poststressed syllable, which is also the prefinal syllable, and then the pitch falls into the final syllable. However, the observation of cases where the final nuclear word has additional posttonic syllables should clarify the issue. In these cases, the endpoint of the rising pitch is always the prefinal syllable, and not the first poststressed syllable, as illustrated in (23a).

(23)   a.[As meNInas **LEram-no-la**]I
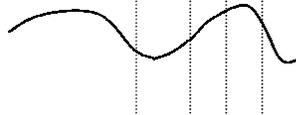
                        le   ram no la
        b.   L*+H H L
           the girls   read-CL-CL
           'Did the girls **read it to us**?'

This is unlike what happens in the non-final nuclear words, where the endpoint of the rise always coincides with the postnuclear syllable (see Fig.7B-C and (21b-c) above). The bitonal boundary account provides a straightforward explanation for such a difference (see (23b)): the pitch goes on rising into the prefinal syllable due to the presence of a boundary H target in the late focus cases, but not in the early focus ones. The same facts are hardly accommodated under the single-tone Li analysis.

A consequence of assuming a bitonal HLi tone is the positing of two succeeding H targets in the late focus contour. Under similar conditions, a phonetic result that has been described for other languages is the higher level of the second H relative to the preceding one (e.g. Pierrehumbert's 1980 upstep rule for English, also applied to Bengali in Hayes & Lahiri 1991). The same effect has already been found in EP declaratives at the right-edge of non-final I-phrases, where the rise after a falling accent is lower than the rise after a low-rising accent (see Vigário 1998, who analyses the two cases as, respectively, H+L*H% and L*+HH%). Clearly, then, the bitonal HLi analysis predicts that the same kind of effect will arise in the late focus contour, but not in the early focus contour. The inspection of the data shows that the range of the rise is indeed wider in the late focus contour than in the early focus one. Moreover, the value reached by the peak in the late focus contour is typically the highest in the utterance, whereas in the early focus cases the accentual peak is lower than the boundary peak. Both these facts are illustrated by the contours in Fig.7. In conclusion, the data supports the bitonal boundary tone analysis.

We therefore propose the following phonological representation of the narrow focused yes-no question nuclei in EP:

(24)   Narrow focused yes-no question nucleus
                    [… [… ˈσ …]ω …]I
                              | |
        a. final   L*+H   HLi
        b. non-final   L*+H   LHi

This analysis is illustrated in (25), for the contour in Fig.7A.

(25)   [Os raPAzes comPRAram **LÂminas**]I
                | | |
              H*   L*+H HLi
        'Did the boys buy **slides** (for the microscope)?'

3.4. Summary: phonological analysis of interrogative nuclear contours

The fall-rising nuclear contour characteristic of neutral yes-no questions, the rising-falling contour that signals late focused interrogatives and the rise-fall-rise of early focused interrogatives have all been captured by means of a unified analysis that posits an accentual tone and a boundary tone. In all the cases, both the accentual and boundary tones are bitonal events. As to the wh-question nucleus, it has been given the same analysis of the neutral declarative nucleus. The optional final rise that may be found in wh-questions is easily accounted for by the bitonal boundary tone typical of interrogative intonation. Table II provides an overview of the analysis of interrogative nuclear contours in European Portuguese.

Table II about here

Like in declarative intonation, neutral and focused questions are assigned distinct contours. Also similarly to declaratives, it is the nuclear accent that bears the distinguishing function irrespective of the final or non-final position of the nuclear word in the I-phrase.

4. On the nature of the intonational markers:

the neutral/focus and the declarative/interrogative distinctions

It has been shown in the previous sections that focus is intonationally signalled both in declarative and in interrogative utterances. Furthermore, the difference between declaratives and interrogatives is also marked by intonation. The nature of these two intonational distinctions is discussed in the present section.

The intonational signalling of focus in EP is characterised by three main properties: first, the focalised word bears a special pitch accent, which contrasts with its counterpart in a neutral utterance (H*+L contra H+L* in declaratives, and L*+H contra H+L* in interrogatives); second, the nuclear pitch accent contrast holds irrespective of the position of the focused word in the intonational phrase; and third, no other systematic tonal distinction, namely of the edge-related type, can be ascribed to the neutral/focus difference. We have thus to conclude that the focus marker in EP is carried by the nuclear pitch accent. A similar analysis has been proposed for the neutral/narrow focus distinction in the declaratives of Palermo Italian (H+L* vs. H*+L, cf. Grice 1995), Neapolitan (H+L* vs. L+H*, cf. D'Imperio 1999), and Standard Italian (H+L* vs. H*, cf. Avesani 1999). By contrast, in Bengali the neutral/focus distinction in declaratives is signalled by a whole tune difference (H* Li vs. L* Hp Li, cf. Hayes & Lahiri 1991). A third option seems to be instantiated by Spanish declaratives where, according to Hualde (2000), Nibert (2000) and Face (this volume), the neutral/narrow focus difference may be signalled by the presence versus absence of an edge-related low tone. A similar strategy appears to be also used in Catalan (Prieto, p.c.).

Unlike focus, interrogation in EP is signalled by tonal boundary marking. To the exception of wh-questions, which are structurally distinct from declaratives (due to the presence of the wh-word and word order effects) and thus do not require an obligatory tonal marker, the interrogative marker is carried by the I-boundary tone. The most salient property of this marker is its complex structure: in EP, a bitonal boundary tone indicates interrogation. In resorting to boundary tones to bear the declarative/interrogative distinguishing function, EP is like Standard Italian, Peninsular Spanish or French (L% vs. H%, cf. Avesani 1995, Sosa 1999, and Post 2000, respectively), and unlike Neapolitan, Palermo or Bari Italian where it is solely the nuclear accent that bears the interrogative marker (L+H* in Bari, L*+H in Palermo and Neapolitan vs. H+L*, cf. Grice 1995, Grice & Savino 1997, D'Imperio 1999, and D'Imperio & House 1997). It is also unlike Catalan, where the boundary tone or the nuclear tone may alternatively bear the interrogative marker (H% or H+L*, cf. Prieto 1995, 2000).[9]

The structural position of the EP focus and interrogative tonal markers in the tone tier is represented in (26). Its orthogonal nature allows the four intonational contrasts found in the data: (i) neutral declarative/focused declarative; (ii) neutral interrogative/focused interrogative; (iii) neutral declarative/neutral interrogative; and (iv) focused declarative/focused interrogative.

(26)   [… [… ˈσ …]ω …]I

| | | | ← interrogative marker
| Tone tier | T* | Ti |
                 └─ focus marker
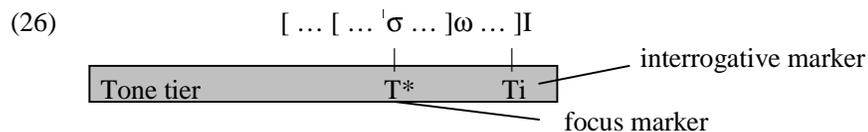
As in Standard Italian, Peninsular Spanish and many other languages, the common boundary marking of a question in EP is a final rise. However, it has also been shown that the complex I-boundary characteristic of EP question contours may

take two different forms: LHi and HLi. The second form is restricted to the late focus contour. An interaction between the functional role of the focus and the interrogative markers may explain this variation. Assuming that the typical form of the bitonal boundary is LHi, the presence of such marker indicates that a question has been made. In addition, the combination of this marker with the neutral accent indicates a broad focus question. If a particular constituent is focalised in a question, the focus marker L*+H is used. In a focused question, the interrogation falls on the focalised constituent and not on the whole utterance. In other words, L*+H means that a specific constituent is being *questioned* about. This makes the boundary rise redundant and thus it can be replaced by the less costly fall, unless some ambiguity may arise as to the global status of the utterance as a question. The early focus contours are prone to such ambiguity, because here L*+H is farther away from the I-boundary and HLi would be phonetically similar to a declarative fall. In this case, and despite its redundant flavour, LHi clarifies the interrogative status of the utterance.

A final remark on the phonological status of H+L* in EP is required. The H+L* accent is used in the nuclear contours of neutral declaratives, wh-questions, and neutral yes-no questions. It is also H+L* that appears as a postnuclear accent in the early focus declarative and question contours. Both the frequent use of H+L* as well as its appearance in postnuclear position are highly suggestive of the unmarked status of this accent in the European Portuguese tonal inventory (similarly to what has been defended for Italian by Grice 1995 and Avesani 1999).

5. Conclusion

In this paper, a phonological analysis of European Portuguese declarative and question intonation has been proposed. It was shown that the typical prenuclear contour of European Portuguese is formed by a high plateau, which may span several lexical words that do not bear a pitch accent. This sparseness of tonal events within the prenuclear stretch is a distinctive feature of European Portuguese intonation that sets this language apart from other Romance languages, such as Italian, Spanish, and Brazilian Portuguese. With regard to the nuclear contours, on which the bulk of the analysis was centred, it was shown that a system of phonological contrasts between accentual tones and intonational-phrase boundary tones was able to capture all the contours examined. In European Portuguese, the phrase accent category can be dispensed with in the analysis of declarative and interrogative nuclear contours. It is the I-boundary tone that bears the declarative/interrogative distinguishing function, while the nuclear pitch accent carries the focus marker. As a result, both broad focused and narrow focused declaratives and (yes-no) interrogatives, which have all the same surface syntactic form, are unambiguously signalled by intonation.

By putting forward a specific proposal regarding the phonological representation of the nuclear contours of the most basic utterance types, this paper offers a contribution to the discussion of the fundamentals of European Portuguese intonation. Hopefully, it will also contribute to enrich the knowledge of intonational similarities and differences across languages, in particular within Romance.

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Notes

[1] In languages such as Bengali or EP (see, respectively, Hayes & Lahiri 1991 and Frota 2000a), the prosodic structure relevant to intonation is that provided under the Prosodic Hierarchy Theory (e.g. Nespor & Vogel 1986, Hayes 1989, among many others). The prosodic word, the phonological phrase and the intonational phrase will thus be the prosodic constituents used in the intonational description that follows (for a definition of these constituents in EP, see Vigário 2001 for the prosodic word, and Frota 2000a for the phonological and intonational phrases).

[2] The initial rise of EP is analysed in this paper by means of a monotonal H* accent. Although most of the data available seem to support this analysis, the phonological status of the initial rise is yet an open issue due to the variable alignment of the peak around the first stressed syllable (see Grønnum & Viana 1999 and Frota 2000a:Chap.5).

[3] Quantitative phonetic data (comprising both F_0 and duration) bearing on the phonological organisation of nuclear falls in European Portuguese declaratives with a broad focus or a narrow focus reading is extensively presented and discussed in Frota (2000b).

[4] The contour in Fig.2A is a natural answer to a question such as *E o Roberto e a Maria?* 'What about Roberto and Maria?'', whereas the contour in Fig.2B is unacceptable as an answer to the same question but the appropriate answer to a question like *Eles separaram-se?* 'Did they split up?'.

[5] Note that an analysis that allows for desequencing (e.g. Gussenhoven 2000) would not provide an adequate account of the EP data, either. We can see no motivation for postulating the ordering phrase accent-final pitch accent in the EP early focus contour, as the contour is not influenced by the length of the segmental string *after* the phrase-final stressed syllable.

[6] Bitonal boundary tones are notated as TTi and not TiTi, as the latter notation may be seen as ambiguous between a complex boundary and a sequence of (independent) boundary tones (I am grateful to Mary Beckman for calling my attention to this point). The TTi notation is here assumed to be equivalent to TT%, as used in Jun' s 1996 description of Korean or Godjevac' s 2001 description of Serbo-Croatian.

[7] The interpretation for the focused yes-no questions in Figure 6 is given below: (A) *Gostaria de saber se foram mesmo lâminas que eles compraram e não outro objecto qualquer* 'I would like to know if they have bought slides and not something different'; (B) *Li o poema a que te referes mas não sei se é*

a manhã ou a noite que o poeta considera angelical 'I have read that poem but I'm not sure whether the poet regards the morning or the evening as angelical'; (C) *Eu vi esse filme mas já não me lembro quem anda de porsche* 'I've seen that movie, but I don't recall who drives a Porsche'.

[8] The only difference between the declarative and interrogative postnuclear accents is the absence of a narrow range fall in the latter. Although this issue will not be pursued here, it seems clear that the non-narrow range of the postnuclear fall does not undermine the primary accent status of the nuclear rise, as focus can only be signalled by L*+H in interrogatives.

[9] The two variants of yes-no questions in Catalan, however, appear to the related to a non-intonational factor — the presence of the expletive particle *que*. On the one hand, sentences with this particle have always a falling contour with the nuclear tone H+L* and a low boundary. On the other hand, this particle is optional and thus the reverse situation (i.e. sentences with no particle have a rising contour) is not necessarily true.

Table I. Nuclear accents in European Portuguese declaratives

EP declaratives	Early nuclear accent	Nuclear accent in final word
Neutral	-----	H+L*
Focus	H*+L	H*+L

Table II. Interrogative nuclear contours in European Portuguese

EP interrogatives	Early nuclear accent	Final nuclear accent	Boundary tone early accent / late accent	
Yes-no neutral	-----	H+L*	-----	LHi
Yes-no focused	L*+H	L*+H	LHi	HLi
Wh-	-----	H+L*	-----	Li
				or LHi

Figure Legends

Figure 1. f_0 contours of the declarative sentence *O pintor retratou uma maNHÃ âMbar* 'The artist painted an amber morning': panel A, neutral contour; panel B, focus on **maNHÃ**. Both utterances are phrased into one intonational phrase. The relevant stressed syllables are indicated in capitals, and the orthographic transcription is synchronised with word-initial boundaries.

Figure 2. f_0 contours of *CaSAram* 'They got married': (A) neutral contour; (B) focus contour. The stressed syllable is in capitals.

Figure 3. f_0 contours of the declarative sentence *O poeta/pintor cantou uma maNHÃ angeliCAL* 'The poet/artist sang an angelic morning': panel A, neutral contour; panel B, focus on **maNHÃ**. Both utterances are phrased into one intonational phrase. The relevant stressed syllables are indicated in capitals. Word boundaries are signalled by text alignment.

Figure 4. f_0 contours of the sequences i. **O gaLÃ** ANda… '**The hero** drives…', ii. **As angoLAnas** ofereCEram… '**The Angolans** gave…', and iii. …**às arQUEÓlogas** '…**to the archaeologists**'. Word boundaries are marked by text alignment. The location of the H and L targets of the focus contour is indicated.

Figure 5. f_0 contour of the wh-question *QUEM pinTOU uma maNHÃ âMbar?* 'Who painted an amber morning?'.

Figure 6. f_0 contours of the neutral yes-no interrogatives *O POEta canTOU uma maNHÃ angeliCAL?* 'Did the poet sing an angelic morning?' (panel A), *Os raPAzes comPRAram LÂminas?* 'Did the boys buy slides?' (panel B), and *As meNInas angoLAnas LEram-no-la?* 'Did the Angolan girls read it to us?' (panel C). Word boundaries are signalled by text alignment.

Figure 7. f_0 contours of the focused yes-no interrogatives *Os raPAzes comPRAram LÂminas?* 'Did the boys buy **slides**?' (panel A), *O POEta canTOU uma **maNHÃ** angeliCAL?* 'Did the poet sing an angelic **morning**?' (panel B), and ***O gaLÃ** ANda de PORche?* 'Does **the hero** drive a Porsche?' (panel C). Narrow/contrastive focus is indicated in bold. Word boundaries are marked by text alignment.

Figures in the hard copy.