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The Intonational Phonology of Peninsular Spanish and European Portuguese

Abstract

The study of Spanish and Portuguese intonation within the Autosegmental Metrical (AM) framework has developed substantially over the past 30 years, and recent applications of common methodology make comparative studies more feasible. Here we compare the intonational systems of Peninsular Spanish (PS) and European Portuguese (EP), considering previous research on prosodic hierarchy, phrasing and tonal density. Finally, we compare the two tonal inventories and their respective (ToBI) labeling conventions. We find a considerable amount of overlap in terms of phonetic implementations of the tonal categories, showing, at times, labeling differences. We use this comparative analysis (i) to discuss these labeling differences and (ii) to motivate the need for uniform but also transparent labeling conventions in order to account for variation across Ibero-Romance varieties and as the field moves forward, Romance varieties.

1. Introduction

In this chapter we provide a comparative account of the inventories of pitch accents and boundary tones known to be used in Peninsular Spanish (PS) and European Portuguese (EP). These specific varieties of Spanish and Portuguese are those that have been best described intonationally to date. As Hualde & Prieto (in press) quite eloquently point out in their own account of Spanish intonation:

"Our description has been biased towards Peninsular Spanish because this is the variety that has so far received the greatest attention in intonational research, and is also the one that the authors of this chapter know better. An unfortunate consequence of this decision is that this may give the impression that this variety is somehow more central or less and that other dialects are to best described in comparison with the Peninsular "norm". Most emphatically, this is not the case. Our greater emphasis on Peninsular intonation is simply a reflection of our ignorance."

We take the same view on the varieties discussed here. Peninsular Spanish varieties have been described intonationally as early as the 20th century, beginning with Navarro Tomás' groundbreaking work (Navarro Tomás, 1918; Navarro Tomás, 1939; Navarro Tomás, 1944). Research within the Autosegmental Metrical (AM) model (Pierrehumbert,

1980; Pierrehumbert & Beckman, 1988; Ladd, 1996/2008; Gussenhoven, 2004; Jun, 2005, among others) for the intonational analysis of PS (Sosa, 1991, 1999; Prieto, 1998; Prieto et al., 1995, 1996; Nibert, 1999, 2000; Face, 2002) begins in the late 20th century. As for European Portuguese (EP), Viana (1987) is known to be the first to look at intonation in this variety, providing a phonological description with phonetic details as evidence. Frota (1993) is the first approach to phonological constituents above the Prosodic Word, providing segmental, durational and intonational evidence for phrasing. This research is developed in Frota (1995), which gives a detailed analysis of sandhi phenomena as a cue for prosodic constituency. The author's proposals are discussed in subsequent studies (Falé, 1995; Vigário, 1995). Frota (1998/2000) later applies the AM model to the study of EP intonation, focusing on tonal association, target alignment and scaling (Frota, 2002a, 2002b, 2003). The first discussion of dialectal variation in EP intonation appears in Vigário & Frota, 2003. In sum, there have undoubtedly been significant advances in the intonational descriptions of both PS and EP within the AM framework during the last three decades and we thus find ourselves at a point where the intonational phonologies of Spanish and Portuguese spoken on the Iberian Peninsula are ripe for comparison.

The layout of this chapter is the following: we present background on existing comparisons of PS and EP from a prosodic point of view, discussing prosodic structure, phrasing patterns and tonal density. We describe common methodology that has been applied in the most recent studies on Spanish (Prieto & Roseano, 2010) and Portuguese (Cruz & Frota, 2012; Frota et al., 2011; Frota et al., in press) and allows us to present the inventories of pitch accents and boundary tones that have been described for PS and EP

using their respective ToBI (for Tones and Breaks Indices) systems (Sp_ToBI and P_ToBI)¹. We then discuss the inventories from a comparative/contrastive point of view taking into consideration both phonotactics and phonetic implementations.

2. Prosody in two Ibero-Romance varieties

2.1. Prosodic hierarchy

Prosodic hierarchy has been claimed to be universal (Nespor & Vogel, 1986/2007), but some prosodic domains do not seem to play a role in the phonology of a given language, or are entirely absent (Frota, 1998/2000; Vigário, 2003). In previous work (Hayes & Lahiri, 1991; Frota, 1998/2000; Hellmuth, 2007, inter alia) evidence for phrasing has been shown by different types of phonological phenomena such as segmental processes, and duration, as well as segmental phenomena constrained by prominence, rhythmic properties and intonational phenomena. These phonological phenomena have also been used as evidence for *levels* of phrasing, and while a given level may be present in one language variety, it may not be found for another. Several phonological processes, for instance, in languages/varieties like Italian or Brazilian Portuguese (Stress Retraction – Nespor & Vogel, 1986/2007, 1989; Sandalo & Truckenbrodt, 2002) are shown to occur at the Phonological Phrase level, while for Spanish we do not find segmental or intonational evidence at this domain level (Beckman et al., 2002). Nibert (1999, 2000) showed experimental evidence for an intonationally-defined constituent below the Intonational Phrase (IP) level: the intermediate phrase (ip). In fact, Sp ToBI break index values allow for the ip level in its hierarchy (Beckman et al., 2002; Aguilar et al., 2009; Prieto &

¹ ToBI systems are conventions for the transcription of intonation and other prosodic aspects of speech that to date are language-specific.

Roseano, 2010). In Spanish, the ip (labeled as a level 3 disjuncture in Sp_ToBI) is signaled by intonational marking: a H- phrase accent, or a continuation rise (Nibert, 2000; Frota et al., 2007). To date, there has been no evidence for an intermediate phrase level in Portuguese². Neither is there evidence for the domain of the Phonological Phrase, though it does seem to play a role in the phonology of the language - specifically in strengthening processes, vowel deletion and pitch accent distribution in prenuclear position. In both PS and EP, the IP is the strongest constituent of the prosodic hierarchy. In EP it is the domain for sandhi phenomena (e.g. fricative voicing, vowel deletion, *inter alia*), pre-boundary lengthening, minimal tune (only the IP head must bear a pitch accent) and, tonal boundary marking is only required at the right edge), the locus for potential occurrence of pauses at the edge (Frota, 1998/2000, 2002a, 2003, in press; Vigário, 2003).

2.2. Intonational phrasing

It is only during the last decade that comparative studies between Spanish and Portuguese prosodic systems have been developed, many of which have been part of the *Intonational Phrasing in Romance* project (Elordieta et al., 2003; Vigário & Frota, 2003; D'Imperio et al., 2005; Elordieta et al., 2005; Frota & Vigário, 2007). This project was designed to describe and analyze the prosodic constituents of some European varieties of Romance (European Portuguese, Peninsular Spanish, Central Catalan and Italian) focusing on intonation constituency. Within Ibero-Romance, (S)(VO) was found to be the most common pattern in PS, regardless of the number of syllables (syllable weight) or

The Phonological Phrase is considered a strong constituent in Brazilian Portuguese (BP). It is the relevant domain for pitch accent distribution, since every PhP head is pitch accented (Frota & Vigário, 2000; Tenani, 2002) in this variety. Fernandes-Svartman (2007) shows that even the Prosodic Word plays an important role in BP, since Prosodic Words bear pitch accents in that variety.

syntactic complexity. In Standard European Portuguese (hereafter SEP) S, V and O are typically grouped together into one single IP, while the (S)(VO) pattern is only favored for long branching subjects (8 syllables min.). Therefore, subject length (in # of syllables), rather than syntactic complexity, triggers phrasing choice in SEP. While object length was not shown to be a significant factor for either PS or EP, Elordieta et al. (2005) suggest the possibility that branchingness indeed plays a role in the (S)(VO) phrasing pattern in PS. The (S)(VO) pattern becomes even more frequent with branching objects when compared to non-branching objects for PS. D'Imperio et al. (2005) later used the same corpus to investigate whether syntactic or prosodic complexity influence prosodic phrasing choices. The authors concluded that branchingness plays an important role only in PS, since branching subjects and objects favor the (S)(VO) phrasing pattern. The results from this study indicate that constituent branchingness relies on prosodic branchingness (a prosodic phrase can contain a maximum of two prosodic words). Differences in the acoustic correlates of the prosodic boundaries were also identified between PS and EP. For instance PS was found to have higher high boundary tones than EP. They are also different in terms of pitch reset: in PS very low initial peaks occur after prosodic breaks, but in EP peaks after a boundary tend to be scaled at the same height of the very first peak of the utterance (D'Imperio et al., 2005).

Vigário & Frota (2003) and Frota & Vigário (2007) also inspected the influence of syntactic and prosodic factors on intonational phrasing in Northern European Portuguese (hereafter NEP) and compared it with SEP. Like PS, but differently from SEP, the (S)(VO) phrasing pattern prevails in NEP, even in non-branching conditions. Additionally, object length affects phrasing pattern choice in NEP, unlike SEP. PS was

also found to be similar to SEP and NEP (as well as Central Catalan and Italian) in that the main boundary cue of the internal IP is a high boundary tone, preceded by a rise on the last stressed syllable. The similarities between PS and NEP in terms of phrasing preferences led to the suggestion that SEP would have evolved from NEP and Spanish, producing larger major prosodic phrases and reducing phrase-internal pitch accents. In this way it has been suggested that SEP is a more innovative Ibero-Romance variety with respect to phrasing.

2.3. Pitch accent distribution

Pitch accent distribution has also been shown to be related to prosodic phrasing (in addition to information structure, prosodic constituent weight, speech rate and speech style) (Vigário & Frota, 2003 and Frota & Vigário, 2007 for European Portuguese; Hellmuth, 2004, 2007 for Egyptian Arabic). Vigário & Frota (2003) and Frota & Vigário (2007) observe that unlike many varieties of Spanish or even in Brazilian Portuguese (Frota, 1998/2000, 2002a; Frota & Vigário, 2000; Hualde, 2002), SEP shows sparse pitch accent distribution (17-27% of IP-internal stressed syllables are pitch accented). NEP (unlike SEP), is characterized by a higher tonal density (74% of IP-internal stressed syllables bear a pitch accent), with almost one pitch accent per Phonological Phrase. In this sense, NEP resembles Spanish (Hualde, 2002) since many varieties of Spanish present one pitch accent per prosodic word in declarative utterances. Thus we point out two main aspects in which NEP is more comparable to PS than it is to SEP: (i) *phrase length* - PS and NEP prefer shorter phrases with (S)(VO) as a dominant phrasing pattern, while SEP prefers longer phrases, and (ii) *tonal density* - PS and NEP (as well as

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³ Brazilian Portuguese also presents a rich pitch accent distribution with 80% of IP-internal stressed syllables bearing a pitch accent (Frota,in press; Frota & Vigário, 2000 and Tenani, 2002).

Brazilian Portuguese) prefer patterns of higher tonal density (one pitch accent per prosodic word), with SEP preferring low tonal density. Vigário & Frota (2003) make the case that phrase length and tonal density are interrelated (i.e. fewer accents may favor fewer phrases). Recent work on central-southern varieties of EP (Cruz & Frota, submitted) however, shows that phrasing and pitch accent distribution vary independently across varieties, though their relevant role for the characterization of the intonational system has been recognized.

3. Spanish and Portuguese in the AM framework

The comparison presented in Section 4, as noted above, is based on a common methodology of data collection recently used in intonational studies of Romance. This method, referred as the Discourse Completion Test (DCT) (Kasper & Dahl, 1991; Prieto, 2001), is designed to elicit the production of an utterance with a specific sentence type/pragmatic meaning by providing the participant with everyday situations presented orally by the interviewer (or with images, as in Figure 1),

(1) Interviewer: Mira el dibujo y di lo que hace la mujer. (Spanish)

Olha para o desenho e diz o que (é que) a mulher faz. (Portuguese)

Look at the drawing and say what the woman is doing.

Speaker: Bebe una limonada./Está bebiendo limonada.(Spanish)

(Ela) bebe (uma) limonada. (Portuguese)

She's drinking lemonade.

Figure 1 – Image used simultaneously with oral context transcribed above to elicit a neutral declarative.



This method has been found to be useful in obtaining a wide range of intonation contours, such as statements, yes-no questions, wh- questions, echo questions, imperatives, and vocatives.

This new common methodology also includes a maptask (using similar methodology to the HCRC map task corpus - http://groups.inf.ed.ac.uk/maptask/) designed to elicit interrogative utterances with varying pragmatic functions and a short interview. This methodology has been used for the creation of online, interactive atlases⁴ that are available for both Spanish (Atlas interactivo de la entonación del español (Prieto & Roseano, eds. 2009-2010 - http://prosodia.upf.edu/atlasentonacion/) and Portuguese⁵ (InAPoP - Interactive Atlas of the Prosody of Portuguese (Frota & Cruz, ed., 2012-2014 http://www.fl.ul.pt/LaboratorioFonetica/InAPoP/) and include many varieties of these languages. Another result of the creation of this common methodology is a first step towards the development of a common transcription system for Romance languages within the Tones and Break Indices (ToBI) framework: IARI - Interactive Atlas on Romance Intonation. In addition to this, Frota & Prieto (in press) discuss the tonal inventory/prosodic systems of nine Romance languages from a comparative perspective with the long-term goal of developing a common approach to the transcription of intonation for Romance languages. These recent developments have also allowed for the revision, as well as the expansion of the Spanish and Portuguese ToBI systems. The Spanish ToBI system (Sp ToBI) is a result of the 1st Sp ToBI Workshop (The Ohio

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⁴ The *Atles interactiu de l'entonació del català* (Prieto & Cabré, eds., 2007-2012) the *Atlàs interactiu de l'intonacion de l'occitan* (Prieto & Sichel-Bazin, eds, 2007-2012) also use this methodology.

⁵ The *InAPoP* also includes a reading task and in addition to analysis of sentence types/meanings, it also comprises the analysis of tonal density, prosodic phrasing and rhythm.

State University – 1999), with its preliminary proposal published in 2002 by Beckman (et al.). Three subsequent Sp_ToBI workshops have taken place since then, and the most recent Sp_ToBI proposal is that of Estebas-Vilaplana & Prieto (2009). The Portuguese transcription conventions (P_ToBI) were proposed more recently (Viana & Frota, 2007; Frota, in press; Frota et al., in press). Both Sp_ToBI and P_ToBI continue to be improved as data from additional varieties become available.

In the following section, we compare the intonational systems of PS and EP. In this way we add to the research developed on the basis of a cross-comparison between Spanish and Portuguese, which up to this point has been based mainly on phrasing and tonal density. We use the following varieties of PS and EP in our comparison: Castilian Spanish (CS) (Face & Prieto 2007; Estebas-Vilaplana 2009; Estebas-Vilaplana & Prieto 2009; Estebas-Vilaplana & Prieto 2010), Cantabrian Spanish (CantS) (López-Bobo & Cuevas-Alonso 2010) and Jerez Andalusian Spanish (JS)⁶ (Henricksen & García-Amaya 2012). For European Portuguese, we include SEP (Frota, 1998/2000, 2002a, 2002b 2003, in press) and NEP (Frota & Vigário, 2003) as well as the Portuguese spoken in Oporto (PorP), Alentejo (AleP) and the Algarve (AlgP) (Cruz & Frota, 2012; Frota et al., 2011; Frota et al., in press). This comparative analysis benefits from the common methodology we have described above. Thus, in the next section, we compare the tonal inventories of PS and EP, drawing on recent findings about the intonational phonology of these two varieties within the AM framework.

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⁶ As the name Peninsular Spanish used in this chapter indicates, only varieties of Spanish that are actually spoken on the Iberian Peninsula were included in the comparison, and for this reason we do not discuss the inventory of the variety of Spanish spoken in the Canary Islands, even though this is a part of Spain.

4. Peninsular Spanish and European Portuguese tonal inventories

4.1. Monotonal pitch accents

Comparing the pitch accent inventories of PS and EP, both present two types of monotonal pitch accents: L* and H*. The L* pitch accent occurs in nuclear position for both PS and EP. L* was not included as part of the initial Sp ToBI proposal (Beckman et al., 2002), but was added as part of the phonological inventory in Estebas-Vilaplana & Prieto's (2009) revised Sp ToBI proposal. In addition, we find a H* pitch accent for both PS and EP. The phonetic realization of both L* and H* is described in the same way for both languages, though an additional phonetic realization is claimed by Henriksen & García-Amaya (2012) for JS. In JS, H* may also be realized as a continuous rising F0 after a L+H* accent. In EP, H* usually corresponds to an initial peak associated with the first stressed syllable, thus marking the left periphery of an IP (see Frota, 2003 for further details on initial peaks in EP), though it may also be used as a nuclear pitch accent, as in the case of vocatives (both vocatives used as a greeting and insistent vocatives). H* has been shown to occur mainly in nuclear position in PS (though Beckman et al. suggest that it may be used as a place holder for ambiguous cases of prenuclear rising accents), and tends to be associated with different types of question meaning in nuclear position.

4.2. Bitonal pitch accents

The bitonal pitch accents in the two varieties can be grouped into two types, based on their local direction: falling and rising. While EP shows evidence for two types of falling bitonal pitch accents, PS shows evidence for only one - H+L*. For both PS and EP, H+L* has been shown to be restricted to nuclear position. An additional falling pitch accent, H*+L, is found in EP, hence we find a contrast between two bitonal falling pitch

accents. Frota's (2002a) analysis presents evidence for these two categories based on the falls found for different types of focus in EP (narrow vs. broad), and the contrast between the two falling accents is based on alignment. In the broad focus fall, the H tone is aligned with a pre-tonic syllable, with the fall through the accented nuclear syllable to a low target (H+L*). In the "focus nuclear fall" the F0 peak is found in the accented nuclear syllable and does not depend on the early or final intonational nucleus (H*+L). SEP, PorP, AleP and AlgP also exploit this contrast in alignment to convey the difference between broad and narrow focus statements (Frota et al., in press). No such contrast has been shown in PS (see Table 1). Thus EP has a richer falling tone inventory than PS. While PS may not have as many falling accents as EP, the data suggest that PS has a richer rising tone inventory than EP (Figures 2 and 3), with four categories for rising accents having been claimed for PS, versus only two for EP. PS and EP share two rising pitch accent categories, the first of which is L+H*. It is well-documented (Face, 2001; Sosa, 1999; Beckman et al., 2002; Hualde, 2003; Face & D'Imperio, 2005; Face & Prieto, 2007) that in PS early peaks (i.e. a rise to an F0 peak within the nuclear stressed syllable) tend to occur in nuclear position rather than prenuclear position, though Face (2003) shows prenuclear L+H* occurs for 25% of his PS spontaneous speech data. In PS, L+H* can be found in statements, wh-questions, commands and even vocatives. Such a wide distribution across sentences types is not found for L+H* in EP, and in fact across varieties of EP the pitch accent is rather rare. Clear cases of L+H* are only found for PorP for contradiction statements (Frota et al., 2011). In addition to this context, it may also occur as the nucleus of calling contours (Frota et al., 2011; Frota et al., in press). The use of nuclear L+H* in PorP (spoken in Northern Portugal) is perhaps another Spanishlike prosodic trait found in varieties of Portuguese spoken in Northern Portugal.

An additional bitonal rising accent shared by PS and EP is L*+H, which compared to L+H* is considered a late rising accent (the rise may occur as late as the onset of the post-tonic syllable). While the L*+H category itself is shared by both PS and EP, there is a fundamental difference in its distribution: in PS, L*+H is restricted to prenuclear position⁷, while in EP this pitch accent is most commonly documented in nuclear position. Thus to the P_ToBI labeller, the nuclear configuration L* HL% in SP_ToBI could prove confusing, since it is quite possible that P_ToBI might use the L*+H L% label⁸ for the same contour. As common methodologies are applied for the analysis of many Romance varieties, we expect that such issues will be addressed.

Though only two bitonal rising accents are proposed in Beckman et al.'s initial Sp_ToBI proposal, an additional bitonal rising accent is proposed in Estebas-Vilaplana & Prieto (2009), who present a three-way distinction between the rising accents L*+H, L+H* and L+>H* in Spanish (the paper addresses multiple varieties). This three-way phonological contrast was first proposed by Face & Prieto (2007) with different labels. The L+>H* category indicates a rising pitch accent throughout the tonic syllable with a displaced peak, systematically aligned with the end of the Prosodic Word (Prieto, D'Imperio & Gili-Fivela, 2005). Estebas-Vilaplana & Prieto chose the > diacritic following Beckman et al.'s (2005) use of the same diacritic for Mainstream American English ToBI (MAE-ToBI) to indicate displaced peaks. The three rising accents proposed by Estebas-Vilaplana & Prieto include a rise through the tonic syllable with the F0 peak located

⁷ An anonymous reviewer points out that it would be difficult to distinguish L* H% from L*+H H%; it could be that L*+H does appear in nuclear position.

⁸ Only observed in Brazilian Portuguese (see Frota et al., in press, for further details).

within the tonic syllable (L+H*), a low F0 valley on the tonic syllable followed by a rise prior to or at the onset of the post-tonic syllable (L*+H), and a rise through the tonic syllable followed by a displaced F0 peak occurring in a post-tonic syllable (L+>H*). L+>H*, like L*+H, is restricted to prenuclear position in Spanish. Therefore PS and EP have two of the three rising accents in common. EP shows no evidence for a rising bitonal pitch accent with a displaced F0 peak in a post-tonic syllable. Figures 2 and 3 present neutral statements in PS and EP, respectively. PS shows two rising bitonal pitch accents within this short utterance, while EP shows an initial H* and a final falling bitonal pitch accent, H+L*.

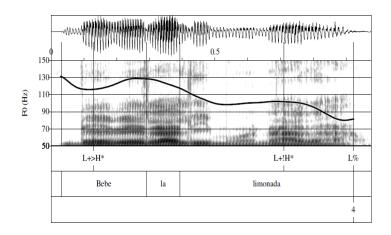


Figure 2 – PS neutral statement *Bebe la limonada* '(She) drinks a lemonade' produced with a nuclear rising accent (recorded by JIH, a native speaker of CS)

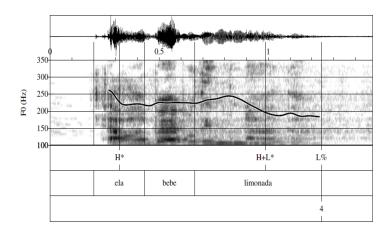


Figure 3 – SEP neutral statement *Ela bebe limonada* 'She drinks lemonade' produced with a nuclear falling accent (extracted from Cruz & Frota, 2012).

Estebas-Vilaplana & Prieto (2010) as well as Henriksen & García-Amaya (2012) show evidence for a fourth label for rising accents in Spanish, L+iH*. Here the i diacritic is used to indicate an extra-high peak, i.e. a tonal gesture that is higher than all the other tonal gestures in the utterance. Both Henriksen & García-Amaya (2012) and Estebas-Vilaplana & Prieto (2008) call attention to the fact that the phonological status of the extra-high tone is unclear. As Henriksen & García-Amaya point out, "It should be made clear that the upstep label in the present analysis was employed to indicate a phonetic result and it remains to be seen whether the higher wh-question peak is of phonological consequence". This differs from the case of Puerto Rican Spanish, for example, where the i diacritic is used to indicate a phonological contrast between iH* and H* based on contrasts between yes-no questions and narrow focus declaratives, for example (Armstrong, 2010). Estebas Vilaplana & Prieto (2010) motivate the need for the L+iH* category given the contrasts between counterexpectational echo questions (L+iH* L%) and various types of statements in PS that use the L+H* L% nuclear configuration in PS.

and we therefore include L+iH* in the inventory of PS pitch accents. In AlgP, the rise L*+H also presents two different ranges in neutral vs. focalized yes-no questions (Cruz & Frota, 2012). For example, scaling of the H tone is systematically higher for focused questions versus neutral questions. While the L tone may be implemented higher in the speaker's tonal space for focused questions, this has not been found to be the case systematically. Cruz & Frota claim that further research is needed in order to investigate whether the wider range of L*+H in focalized yes-no questions is sufficient for listeners to perceive the difference in pragmatic meaning. If this were the case, it would thus support the use of the diacritic i to distinguish between two phonological categories in EP.

Summarizing, we can say that monotonal pitch accents in the two languages show no differences – both PS and EP show evidence for H* and L* with similar phonetic implementations. PS and EP are also fairly similar in their bitonal pitch accent inventories, but with exceptions. PS and EP share the categories H+L*, L+H* and L*+H. EP shows an additional falling pitch accent not proposed for PS (H*+L), while PS shows evidence for rising accents not documented for EP – L+>H* and L+iH*. While there has been reason to motivate the need for using the diacritic for displaced peaks (>) or upstepping (i) in PS, so far this is not the case for EP. These two language varieties show differences in terms of the distribution of pitch accents as well – while L*+H is restricted solely to prenuclear position in PS, it mainly appears in nuclear position in EP. These facts may contribute to Frota's (2002a) observation about the lack of an "iterative highlow pattern" in EP that is commonly described for Spanish and in Brazilian Portuguese".

Phonetic realization	PS	EP	Tonal complexity
Low plateau during nuclear syllable.			
	L*	L*	Monotonal
High plateau with no preceding F0 valley. In JS a continuous rising F0 after a L+H* accent can be found. (JS)	Н*	Н*	Monotonal
Sharp fall in F0 from the pre-tonic syllable to the nuclear one. Low target may be at offset (a) or earlier (b), at the nucleus midpoint. (a) (EP) (b)	H+L*	H+L*	Bitonal
Peak on the stressed syllable, immediately followed by a fall along the post-tonic syllable.		H*+L	Bitonal
Rising pitch movement from the pre-tonic into the nuclear syllable. The peak is known to occur around the syllable point (a), or at its offset (b).	L+H*	L+H*	Bitonal
Very steep rise to peak located in accented syllable. Contrasts with L+H*. For all dialects that show evidence for this pitch accent it is attested in nuclear position.	L+¡H*		Bitonal

Phonetic realization	PS	EP	Tonal complexity
Rising pitch on accented syllable. F0 peak is aligned with post-accentual syllable. low or high tone.	L+>H*		Bitonal
F0 valley good portion or all of tonic syllable with rise into post-accentual syllable. Turning point may actually occur in tonic syllable (a) or occur at the onset of the post-tonic (b).	L*+H	L*+H	Bitonal

Table 1. Monotonal and bitonal pitch accents in Peninsular Spanish (PS) and European Portuguese (EP): phonetic realization and label used within each inventory system. Brackets with the abbreviation of varieties below the representation of the phonetic realization mean that this is the dominant implementation of the pitch accent (Face & Prieto, 2007; Prieto & Roseano, 2010; Henriksen & García Amaya, 2012 for PS; Frota, 1998/2000, 2002a, in press; Frota et al. 2011, in press for EP).

4.3. Boundary tones

4.3.1. Monotonal boundary tones

Both PS and EP show evidence for three levels of contrastiveness for monotonal boundary tones: a low boundary tone (L%), a high boundary tone (H%) and a phonological category whose tonal space is located between L% and H%, !H%. The H in the !H% label indicates that the tonal event is indeed higher than L%, but the ! diacritic indicates that it is realized in a tonal space lower than the speaker would use for H%.

Until very recently, Sp_ToBI used a mid tone label (M%) for this last category (Beckman et al. 2002), while EP has treated this tonal event as a downstepped high boundary tone (!H%). Estebas-Vilaplana (2009) proposed using the label !H% instead of the M% label in the Sp_ToBI system, and Hualde & Prieto (in press) also support this labeling convention. Indeed it is quite attractive since it coincides with the P_ToBI system, and in this sense allows for uniformity between the systems. !H% occurs in CS, CantS and JS for both final and non-final constituents. Its use varies for pragmatic intentions across the three PS varieties we consider here, appearing for multiple intention types. All varieties of EP we have referenced here include the !H% boundary tone, which has a very specific phonetic realization in EP (Table 2) – a downward step into the post-tonic syllable followed by a sustained pitch level (see also Figure 4). This tone is found in all varieties that have been investigated in EP for a specific type of vocative chant ("greeting" vocative chants). In Sp_ToBI this is realized as a rise or fall to a mid target, or a sustained pitch, as we show in Figure 5.

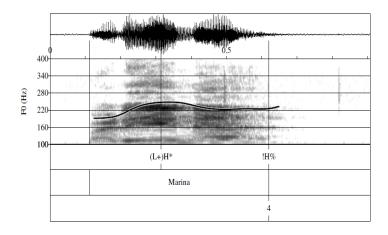


Figure 4 – PorP vocative chant *Marina* 'Marina' produced with a (L+)H*!H% nuclear contour (extracted from Frota et al., 2011).

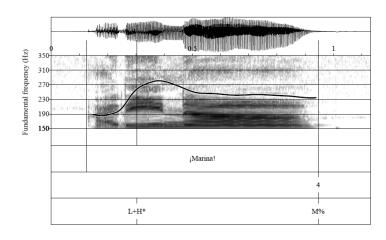


Figure 5 – CS vocative chant *Marina* 'Marina' produced with a L+H* M% nuclear configuration (extracted from Estebas-Vilaplana & Prieto, 2010) This contour is now labeled with a !H% boundary tone, as in P_ToBI (see Hualde & Prieto, in press, for other examples).

It is important to bear in mind that the ! diacritic is not indicative of contextually-conditioned phonetic downstep. The ! diacritic indicates that the tonal scaling of !H% is lower than that found for a third contrastive category in the Sp_ToBI and P_ToBI systems, H%. Thus three levels of contrastiveness are found for monotonal boundary tones in both Sp_ToBI and P_ToBI.

Past accounts of PS have proposed a fourth category, HH% (Figure 6). This HH% label has been used to represent a sharp or extra-high rise to a high boundary. It is important to note here that HH% has always been treated as a monotonal category, which is perhaps counterintuitive based on the two H characters used in the label. Estebas-Vilaplana (2009) also shows production evidence for a distinction between a high boundary H% and an extra-high boundary HH%. On the other hand, neither López-Bobo & Cuevas-Alonso (2010) nor Henriksen & García-Amaya (2012) include H% for CantS or JS, only

HH%. Hualde & Prieto (in press) treat both realizations (those that have been labeled H% and those labeled HH%) as one category: H%. We agree with this decision based on the fact that there has not been, to date, convincing perceptual evidence for a HH% category that contrasts with H%. The P_ToBI system treats the phonetic realization labeled as HH% in prior accounts of Sp_ToBI as H% as well (Figure 7). We therefore support an analysis assuming three levels of contrastiveness for monotonal boundary tones for both PS and EP: L%, !H% and H%.

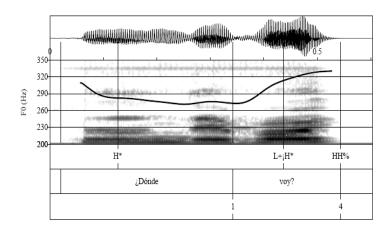


Figure 6 – CS echo wh- question ¿Donde voy? '[Did you ask me] where I'm going?', produced with a L+iH* HH% nuclear pitch accent (extracted from Estebas-Vilaplana & Prieto, 2010). This contour is now labeled with a H% boundary tone, as in P_ToBI (see Hualde & Prieto, in press, for other examples).

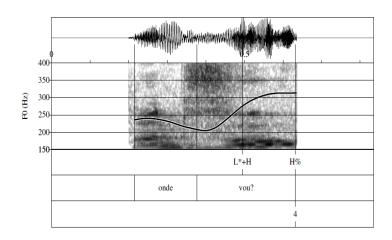


Figure 7 – AlgP echo wh- question *Onde vou?* '[Did you ask me] where I'm going?', produced with a L*+H H% (extracted from Cruz, in progress).

4.3.2. Bitonal boundary tones

PS and EP are also similar in that they show evidence for bitonal (complex) boundary tones, and each variety shows evidence for both rising (LH%) and falling (HL%) complex boundary tones (though this depends on the specific subvariety). For instance, LH% is only proposed for CS (for counter-expectational questions) and not CantS or JS, while for EP it is mainly found for SEP and AleP for varying flavors of yes-no questions, but not for NEP, PorP or AlgP (Frota et al., in press). HL% has been documented for all three varieties of PS discussed here, but again is not found in all varieties of EP. While HL% is found in general for yes-no questions in NEP, it is used specifically for narrow focus yes-no questions in AleP and SEP, and for counter-expectational wh- questions in SEP (Frota et al., in press). Differently from EP, a third bitonal boundary tone has been proposed for PS. Production results (Estebas-Vilaplana & Prieto, 2010; López-Bobo & Cuevas-Alonso, 2010, though not Henriksen & García-Amaya, 2012), have motivated the proposal of what up until recently has been labeled LM% in the Sp_ToBI system. While

the LH% boundary tone is characterized by an F0 valley and a subsequent rise to a high (H) tone, for L!H% (formerly LM%) the subsequent rise is crucially to a phonologically downstepped high tone (!H). The most convincing production evidence for the L!H% category is based on the realization of the bitonal boundary tones used in statements of the obvious in Peninsular Spanish (L+H* L!H%), though it is noteworthy that many non-Peninsular varieties of Spanish coincide in their use of this nuclear configuration for statements of the obvious (Prieto & Roseano, 2010). CS for, example uses L+H* LH% for counter-expectational yes-no questions, but L+H* L!H% for statements of the obvious. The main difference we find is in the bitonal boundary tone inventory. Both the LH% and L!H% categories in PS would correspond to the same category in EP: LH%.

Phonetic realization	PS	EP	Tonal complexity
Low sustained tone at the bottom of the speaker's pitch range, or fall to a low target at the bottom of the speaker's pitch range.	L%	L%	Monotonal
A rise or fall to a mid target (PS) or a sustained pitch level (PS, EP) (PS) (PS, EP)	!H%	!H%	Monotonal

⁹ Vanrell (2011) has shown perceptual evidence for the LH% vs. L!H% contrast in Central Catalan.

Phonetic realization	PS	EP	Tonal complexity
A sustained high F0 mostly occurring after a rising or falling movement within a nuclear syllable. In PS this category includes a sharp or extra-high rise to a target high in the speaker's pitch range (previously labeled as HH%).	Н%	Н%	Monotonal
(PS, EP)			
Low F0 valley followed by a rise to a high tone at the end of the utterance.	LH%	LH%	Bitonal
Low F0 valley followed by a rise to a mid tone at the end of the utterance.	L!H%	LH%	Bitonal
Post-nuclear F0 peak followed by falling pitch movement to the end of the utterance from a previous low (a) or high tone (b). (a) (b)	HL%	HL%	Bitonal

Table 2. Monotonal and bitonal boundary tones in Peninsular Spanish (PS) and European Portuguese (EP): phonetic realization and label used within each inventory system. Brackets with the abbreviation of varieties below the representation of the phonetic realization mean that this is the dominant implementation of the boundary tone (see Prieto & Roseano, 2010; Henriksen & García Amaya, 2012 for PS, and Frota, 1998/2000, 2002a, in press; Frota et al., 2011, in press for EP).

5.0 Discussion

We have compared the tonal inventories for PS and EP based on the common

methodology described in Section 3.1. Starting with pitch accents, we have shown that the inventories of PS and EP are quite similar: they are exactly the same for monotonal pitch accents. The main difference in inventories is found for bitonal pitch accents. We find more rising bitonal pitch accents in the PS inventory, and more falling ones in the EP inventory. This observation is typologically interesting within Ibero-Romance. We have also observed phonotactic differences with respect to the pitch accents available in PS and EP; L*+H never occurs in nuclear position in PS, while it mainly occurs in nuclear position in EP. The L+>H* pitch accent, not present in EP, is also restricted to prenuclear position in PS. We also point out that for PS it is necessary to use diacritics for the pitch accent inventory to indicate alignment (>) as well as scaling (i), while to date neither of these diacritics have been necessary to account for EP pitch accent categories.

With respect to the inventories of boundary tones in PS and EP, there is considerable overlap as well. PS and EP coincide completely with respect to monotonal boundary tones. While prior accounts of PS have proposed a four-way distinction for monotonal boundary tones (L%, M%, H%, HH%), Hualde & Prieto's most recent account proposes just three levels of contrastiveness, since little perceptual evidence was given for 4 levels of contrastiveness. Based on the evidence presented in prior accounts, we are in agreement that three levels of contrastiveness based on tonal scaling exist for PS: L%, !H% and H%. We believe these labels to be transparent in the sense that they do a good job of capturing the pitch movements they represent. Our view is that it is important to maintain transparency such that labels do not overpredict (i.e. too many labels) – we must be careful to preserve the idea of "intonational *phonology*" as we develop labeling systems.

With respect to bitonal boundary tones, PS and EP are similar in that there has been evidence for rising (LH%) and a falling (HL%) bitonal boundary tones, but an additional category is found in PS. Two distinct bitonal rises have been claimed for PS: LH% and L!H% (formerly known as LM%). The bulk of the evidence for this contrast in Spanish has been in production, however, and we point out the need for perceptual work to add to the evidence for this contrast. For all of the categories considered here, we point out that while there is a great deal of overlap in the actual inventories, the use of these categories for PS vs. EP differs substantially in terms of pragmatic division of labor (i.e. how the different categories are related with different meanings in PS and EP). This observation could have important implications for L2 acquisition of PS by EP speakers or vice versa. The labeling issues that have been most problematic in the past largely deal with tonal scaling, at least for the case of Spanish. But debate about representation of levels of pitch scaling is not new. In fact, as Face (2005) points out, earlier intonational models incorporated more than two levels of pitch scaling (e.g. Pike, 1945; Trager & Smith, 1951). In past years, researchers working on Romance intonational phonology have shown evidence that there is a need for more than two phonological distinctions on the vertical scale (Beckman et al., 2002; Face, 2005, 2011 for Spanish; Post, 2000 for French; Borràs-Comes et al., 2010 for Central Catalan; Vanrell, 2011 for Mallorcan Catalan; Frota, in press for European Portuguese; Dabkowski, 2012 for Brazilian Portuguese; Roseano, Vanrell & Prieto, 2011 for Friulian; Savino & Grice, 2007, 2011 for Bari Italian). Thus we agree with Vanrell when she proposes that "There seem to be solid reasons to reassess the concept of upstep and downstep within the AM framework and also to arrive at a consensus between tonal and intonational languages about the use of labels standing for pitch height levels others than L and H" (2011:170). What Vanrell is referring to here is that upstep and downstep have been referred to in the literature as phonetic processes, rather than a feature related to phonological categories as Ladd (1993, 1996:91) has suggested. But the upstep (j) and downstep (!) diacritics have been used, as we see in both the cases of Sp_ToBI and P_ToBI, to mark phonological scaling distinctions. Frota (p.c., Rom_ToBI workshop) has observed that in segmental phonology the same IPA symbol may reference a distinctive feature but also features that are context-specific and rule-generated. For example, voiceless stops in Dutch are distinctive phonologically but stops are also devoiced word-finally. Thus we agree that upstep and downstep diacritics can be used for both purposes in ToBI systems. One solution for ambiguity would be to use separate phonetic and phonological tiers, so the use of the diacritic would be clear.

6.0. Conclusions

We have presented an overview of the tonal inventories for two of the best-described varieties of Spanish and Portuguese to date – Peninsular Spanish and European Portuguese. We have shown that overall, their tonal inventories are similar, with few exceptions. These exceptions reflect certain generalizations: PS has more rising tones (both pitch accents and boundary tones) while EP has more falling tones (pitch accents). In addition to the general directionality of the tones found in PS and EP, we have also shown differences between the languages with respect to tonal scaling. Indeed, there is quite an array of evidence from production that both languages show contrastiveness on the vertical scale (perhaps more so in PS than EP). However, there is a great need for

more perception work on tonal scaling in both Spanish and Portuguese. We believe that these two language varieties (in addition to other varieties of Spanish and Portuguese) will be of great interest to scholars interested in the role of scaling in intonational phonology. Such work will also thrust us forward in creation of unified prosodic transcription systems for Ibero-Romance and more generally, Romance intonation.

While our comparison of PS and EP makes clear that there is a great deal of overlap between the tonal categories, it should also be clear that they are quite different in terms of how these categories are phonetically implemented, where the categories may occur (phonotactics) and the distinct relationships between the intonational forms and their meanings in context. Thus we feel that future comparative work would benefit from carrying out comparisons of systems using a holistic approach that takes into account this dynamic nature of intonational phonology.

Acknowledgements

We gratefully thank two anonymous reviewers for their comments and corrections. A special acknowledgement is also due to Maria del Mar Vanrell, Pilar Prieto and Sónia Frota for their astute suggestions and meticulous review of the final version of this chapter. This research was partially developed within both the *InAPoP* Project (PTDC/CLE-LIN/119787/2010) and an individual PhD Project (BD/61463/2009), funded by Fundação para a Ciência e a Tecnologia.

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