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The Phonological Status of English and Spanish Prenuclear Fo Peaks

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The aim of this paper is to examine the importance of phonetic detail in the phonological interpretation of intonation by analysing the case of rising prenuclear accents in English and Spanish declarative sentences. In order to find out the phonological units that better account for the rising Fo trajectories in the two languages, I recorded one English and one Spanish native speaker producing 45 declarative sentences which contained words with different stress distributions (oxytones, paroxytones and proparoxytones) in prenuclear position. An acoustic analysis was carried out for both languages so as to examine the alignment patterns of the prenuclear rising accents. The results showed that the similar phonetic properties of English and Spanish prenuclear accents respond to two different phonological interpretations, namely an H* pitch accent for English and an H word-edge tone for Spanish.

Keywords: prenuclear accents, Fo alignment, pitch accents, word-edge tones, Autosegmental-Metrical phonology

1. Introduction

Over the last decades a great deal of research on prosody has followed the tenets of the Autosegmental-Metrical (AM) approach to intonation which started with the work of Janet Pierrehumbert in 1980 for the analysis of American English intonation and has been applied to a great number of languages, such as Japanese (Pierrehumbert and Beckman 1988), Bengali (Hayes and Lahiri 1991), Portuguese (Frota 1998), Italian (Grice 1995a; D'Imperio 1999), Korean (Jun 1996), German (Grabe 1998), Greek (Arvaniti and Baltazani 1999), Spanish (Sosa 1999) and French (Post 2000), to mention but a few.

The model proposes the analysis of Fo contours by means of two tones, H(igh) and L(ow), which are associated with elements of the segmental string (accented syllables) and to the edges of prosodic domains (intermediate phrase and intonation phrase). The tones associated with accented syllables are marked with an asterisk (H* and L*), those associated with intermediate phrases are signalled by means of a hyphen (H- and L-)

and, finally, those associated with intonation phrases are indicated with a percentage symbol (H% and L%). The tones of accented syllables can be both monotonal (H*, L*) and bitonal (L*+H, L+H*, H*+L, H+L*). Bitonal accents can be left-headed or right-headed depending on whether the first or the second element of the accent is associated with the metrically strong syllable. As in monotonal pitch accents, the tone associated with the accented syllable is marked with an asterisk.

In this paper I shall analyse the phonological status of prenuclear rising accents in declarative sentences in English and Spanish by means of the AM model. The characteristics of prenuclear accents in English and Spanish declaratives share similar phonetic properties since in both languages an Fo rise is observed in the vicinity of each accented syllable. This is illustrated in Figure 1 for the English sentence *My mother's living in Ireland* and in Figure 2 for the Spanish sentence La *niña mimaba la nena.* Prenuclear accented syllables are underlined. Both languages show a rising Fo movement within or near the accented prenuclear syllables.

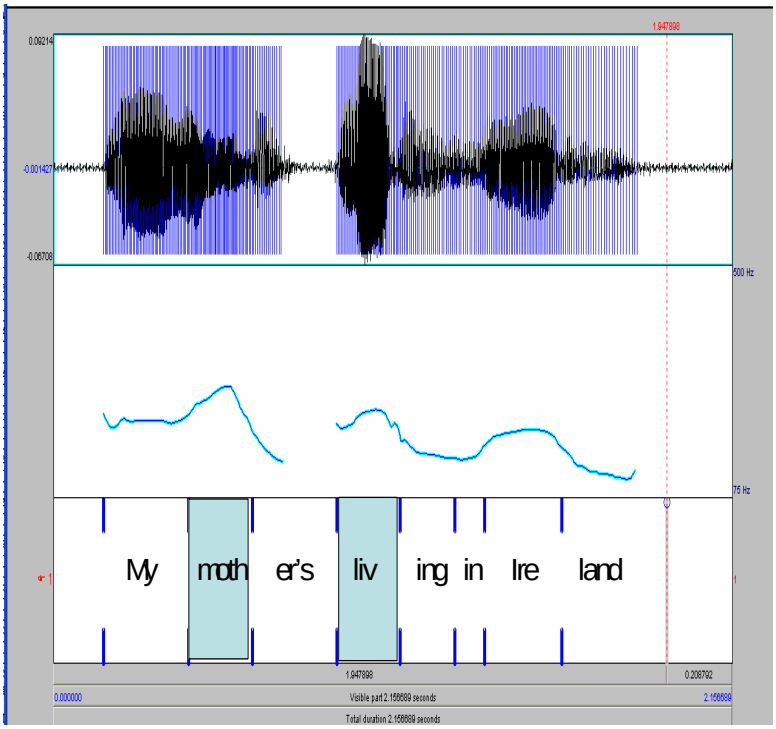

Figure 1. Speech waveform and Fo contour for the English declarative sentence *My mother's living in Ire-land* with two prenuclear rising accents, corresponding to the first two Fo peaks. The beginning of each syllable is marked in the box at the bottom. The grey boxes indicate the accented syllables in prenuclear position.

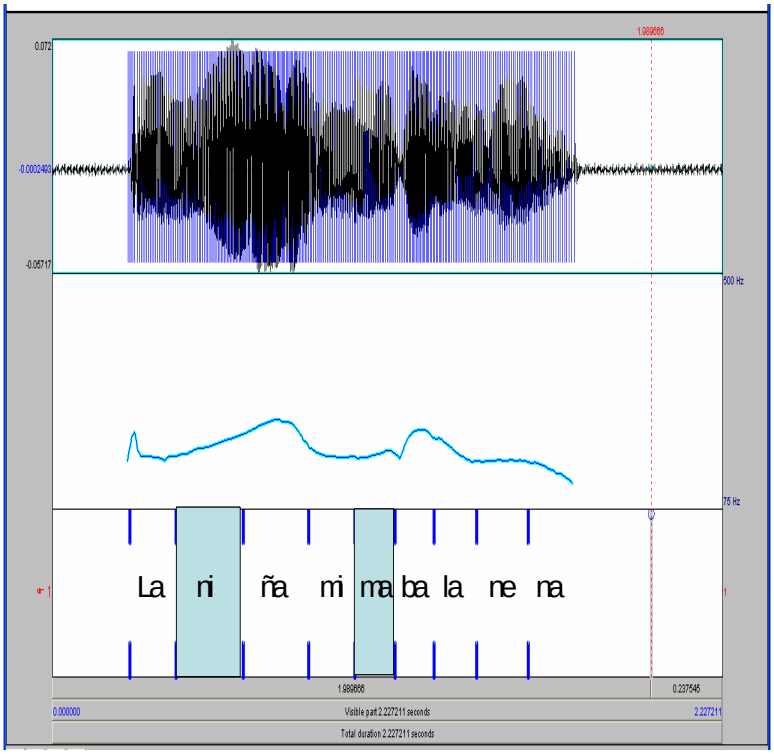

Figure 2. Speech waveform and Fo contour for the Spanish declarative sentence *La niña mimaba la nena* with two prenuclear rising accents, corresponding to the two Fo peaks. The beginning of each syllable is marked in the box at the bottom. The grey boxes indicate the accented syllables in prenuclear position.

Studies on the modelling of prenuclear rising accents in declarative sentences in English (Pierrehumbert 1980) and in Spanish (Prieto, van Santen and Hirschberg 1994, 1995; Nibert 2000) have described such accents as instances of an H* pitch accent. However, a closer phonetic analysis of the Fo rising trajectories of prenuclear accents in the two languages shows a difference in Fo alignment: whereas in English the Fo peak is clearly aligned within the limits of the accented syllable, in Spanish such an Fo peak is located after the offset of the accented syllable. As reported by Prieto, van Santen and Hirschberg as well as by Nibert, this can be explained as a case of an H* pitch accent with a peak delay. According to this interpretation, the same phonological entity describes the Fo rising trajectories in the two languages despite differences in their phonetic behaviour. Further studies on Spanish intonation, however, have proposed a different phonological interpretation for such rises. Sosa (1999), Face (1999, 2002), Beckman *et al.* (2002) and Calleja (2004) describe the rising movement of prenuclear accents in Spanish by means of a bitonal accent (L*+H). This accent involves a low Fo within the accented syllable and a sharp rise after the accented syllable. Hualde (2002), in turn, finds that neither H* nor L*+H describe prenuclear rises in Spanish

satisfactorily. He claims that H* fails to account for the fact that the tone is low at the onset of the stressed syllable. However, he rules out L*+H on the basis that it is not contrastive with L+H*. He proposes a pitch accent where both tones are associated with the stressed syllable (L+H)*. More recent research on Spanish prenuclear rising accents (Pamies 2005; Estebas-Vilaplana 2006) suggests the possibility of analysing those accents as an L* pitch accent followed by an H word-edge tone which signals the end of the accented word. The notation L* H differs from L*+H in that in L* H the H is anchored at the end of the word, whereas in L*+H the H is expected to be fixed in time with respect to L* (Grice 1995b).

In this paper the phonetic properties of English and Spanish prenuclear rising accents in declarative sentences will be analysed in detail so as to clarify the phonological status of the Fo rising movements. I believe that a cross-linguistic study of such Fo traces will help to provide a more accurate phonological interpretation of the two languages. In order to find out the phonological primes that account for prenuclear Fo rises, recordings were made of one English and one Spanish native speaker producing 45 declarative sentences which contained words with different stress distribution in prenuclear position: *oxytones* (words with stress on the final syllable and thus no postaccentual syllables within the word), *paroxytones* (words with stress on the penultimante syllable and thus one postaccentual syllable within the word) and *proparoxytones* (words with stress on the antepenultimate syllable and thus two postaccentual syllables within the word). Words with different stress patterns were used in this study so as to examine the exact alignment of the Fo peak (within the accented syllable or in the postaccentual syllable/s) and hence be able to clarify its phonological status. The hypotheses tested in this paper are the following:

1) If the location of the Fo peak is not affected by the stress pattern of the word, that is, if the Fo peak is always anchored within the limits of the accented syllable, whatever the number of postaccentual syllables, then the phonological entity to describe the high pitch will be an H* pitch accent.
2) If the Fo peak is anchored after the accented syllable but is not affected by the number of postaccentual syllables, that is, it is fixed in time with respect to the accented syllable, then the type of pitch accent will be an L*+H since in bitonal accents the trailing tone is expected to be fixed in time with respect to the starred one (Grice 1995b).
3) If the location of the Fo peak is affected by the number of postaccentual syllables within the word, that is, the higher the number of postaccentual syllables the more displaced the Fo peak, then one might suggest the presence of an H word-edge tone which signals the end of the word.
4) Finally, other than the phonological categories being the same or different in the two languages, we can also consider the possibility that the same tonal entity has different language-specific realisations. For example, one may assume that the same tonal unit is used in the two languages but it may be subject to different realisational strategies, such as truncation or compression. Truncation and compression have been reported in languages such as English or German (Grabe 1998) and involve the adjustment of the Fo trajectories to differences in the length of the segmental string. In shorter sequences, the Fo trajectory of a

rising accent may be truncated (it may end earlier) or compressed (it may be produced with a more rapid rising). If truncation of a rising tone were found in the present data, one would expect the rising movement to end earlier in oxytones than in the other types of words. Similarly, if rising accents were compressed a more rapid rising in oxytones than in paroxytones or proparoxytones would be expected.

In this study I shall examine whether the alignment of the Fo peak in prenuclear accents differs in English and in Spanish. If the location of the Fo peak is affected by the number of postaccentual syllables in one language but not in the other, then the rising trajectories in the two languages cannot be accounted for by means of the same tonal category – as proposed by Prieto, van Santen and Hirschberg (1994; 1995) and Nibert (2000) – but two different entities are needed to describe the rising movements. Based on the phonetic evidence observed in this study, I expect to clarify the phonological status of the rising prenuclear accents in English and in Spanish and decide whether they should be described by means of the same tonal category (with or without realisational differences) or by means of different tonal entities.

2. Experimental procedure

2.1. Data recording

The data examined in this study consisted of 45 Subject-Verb-Object declarative sentences for English and for Spanish consisting of three accents, namely two prenuclear accents and one nuclear accent. The accents in prenuclear position belonged to words with three different stress distributions, i.e. oxytones, paroxytones and proparoxytones. For each sentence the two accented words in prenuclear position had the same stress distribution, that is, they consisted of two oxytones, two paroxytones or two proparoxytones. An example of the different types of words is illustrated in (1) for English and in (2) for Spanish. The labels *fin*, *pen* and *ante* stand for stress on the final, penultimate and antepenultimate syllables respectively. The whole list of sentences used in this paper can be found in Appendix 1 for English and in Appendix 2 for Spanish.

(1)	The boys will present a paper	fin
	My mother's living in Ireland	pen
	Emily damages the window	ante
(2)	*Mamá le miró la mano*	fin
	La niña mimaba la nena	pen
	Los ángeles volábamos sobre el mar	ante

Sentences were constructed to be read aloud and were designed with as many voiced sounds as possible so as to avoid interruptions in the Fo traces and be able to identify the location of the Fo peak in a more reliable way. Both English and Spanish target syllables contained the following combinations of consonants (C) and vowels (V): CV,

CVC, CCV, CCVC, VC (only in Spanish) and CVCC (only in English). The syllabification criteria for English words are in line with Wells (1990).

One speaker of British English (KF) and one of Castilian Spanish (DO) read the 45 sentences twice. Each speaker read 90 sentences. Overall, a total of 180 utterances were recorded. Since each sentence consisted of two prenuclear accents, 360 accents were analysed, namely 120 oxytones, 120 paroxytones and 120 proparoxytones. The recordings of the English data took place at the Phonetics Laboratory of the Department of Phonetics and Linguistics of University College London. The recordings of the Spanish data were done at the Phonetics Laboratory of the UNED. The speakers were asked to read the sentences in a neutral declarative intonation but without any pause or intonational break. Sentences had to be pronounced in a single intonational phrase in order to avoid the presence of an H- phrase accent indicating an intermediate phrase.

2.2. Data analysis

Sentences were analysed by means of the *Praat* software (Boersma and Weenik 1992-2001), which allows for a time-aligned inspection of the speech waveform and the Fo trace. The display in Figure 3 shows the English sentence *My mother's living in Ireland* produced by speaker KF. The four boxes displayed in the graph show the speech waveform, a spectrogram with an overlapped Fo trace, the labels corresponding to the segmental boundaries for all target syllables, and the Fo landmarks (L and H).

For each sentence the following segmental and pitch labels were placed in the two test syllables:

1. Segmental landmarks: onset of each vowel and consonant/s of the two prenuclear accented and postaccentual syllables.
2. Pitch landmarks: Fo valley (L) and Fo peak (H) of the two prenuclear accents.

After segmentation, a Praat script collected the data points into an SPSS file, where the distance measures relevant for our study were calculated, namely the location of H relative to the different segmental landmarks (accented and postaccentual syllables onset/offset and word boundary).

3. Results

In order to find out the phonological entity that better accounts for prenuclear rising accents in English and in Spanish, I shall examine the alignment patterns of the Fo peak in two different ways: 1) H peak delay as a function of the duration of the accented syllable; and 2) the effects of the stress condition of the word (i.e. the effects of the number of postaccentual syllables) on H location.

3.1. H peak delay as a function of the duration of the accented syllable

Previous studies on H alignment in prenuclear rising accents (Silverman and Pierrehumbert 1990; Prieto, van Santen and Hirschberg 1995) have shown a strong correlation between the duration of the accented syllable and the location of the H, i.e. the longer the accented syllable the more displaced the Fo peak. The graphs displayed in Figures 4 and 5 plot H peak delay (or distance between the onset of the accented syllable and the Fo peak in ms) as a function of the duration of the accented syllable for English and Spanish in the three word conditions, i.e. in words with stress on the final (fin), penultimate (pen) and antepenultimate (ante) syllables.

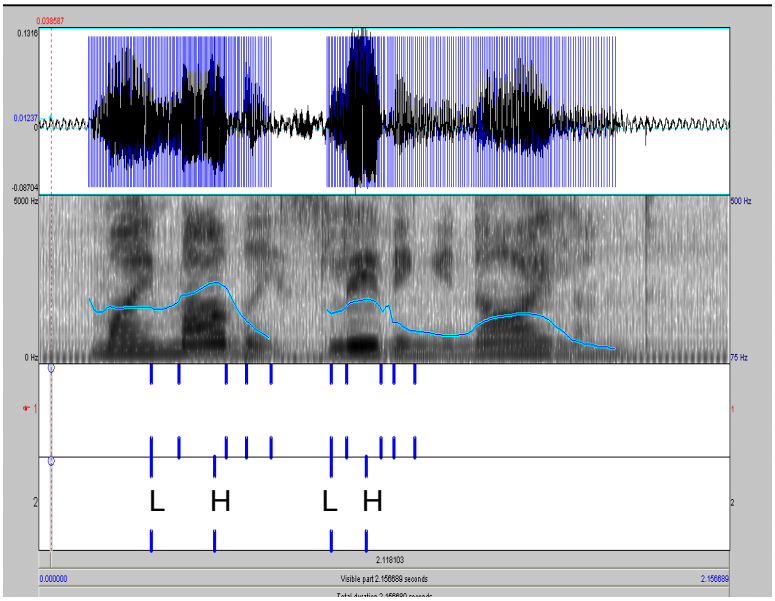

Figure 3. Displays of speech waveform, spectrogram with an overlapped Fo trace, the segmental boundaries and the Fo landmarks (L and H) for the English sentence *My mother's living in Ireland* produced by speaker KF.

The results presented in Figures 4 and 5 show that for both languages the location of the Fo peak is affected by the duration of the accented syllable in such a way that the H is more delayed as the duration of the accented syllable increases. For English (Figure 4), a strong correlation is observed in words with stress on the penultimate (R2=0.702) and antepenultimate (R2=0.767) syllables. Words with stress on the final syllable, on the other hand, show a less strong correlation (R2=0.339).

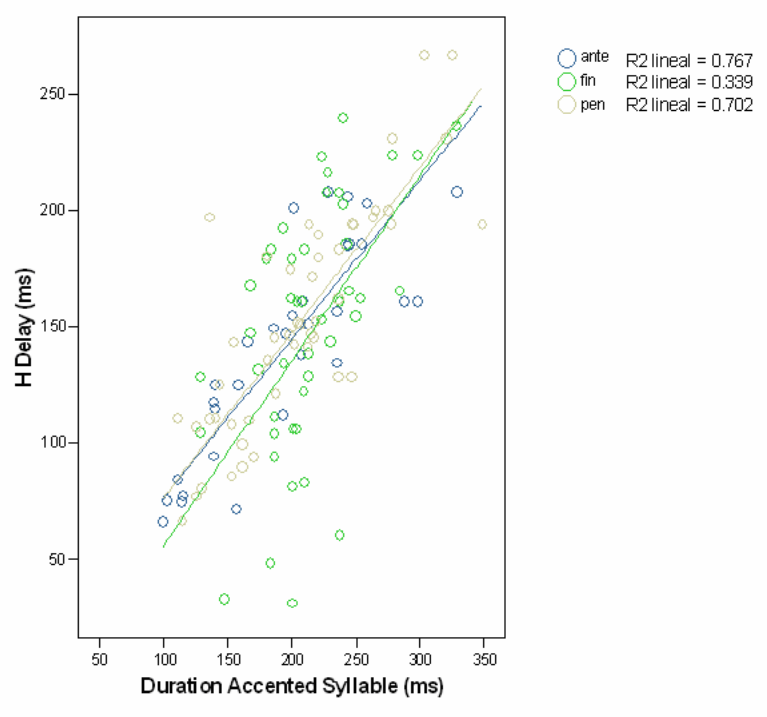

Figure 4. Peak delay (or distance between the onset of the accented syllable and the Fo peak) in ms as a function of the duration of the accented syllable in ms in three stress conditions (words with final, penultimate and antepenultimate stress) for the English speaker KF.

The results of the Spanish data (Figure 5) also show a strong correlation between syllable duration and H delay for words with final ($R2=0.726$) and penultimate ($R2=0.736$) stress. Words with antepenultimate stress exhibit a less strong correlation ($R2=0.421$). Furthermore, the results plotted in Figure 5 also show that Hs in words with a final accent are less delayed than Hs in words with a penultimate accent. Similarly, Hs in words with a penultimate accent are less delayed than Hs in words with an antepenultimate accent. This seems to indicate that in Spanish the location of the H is highly influenced by the number of postaccentual syllables within the word. These effects will be examined in the next section.

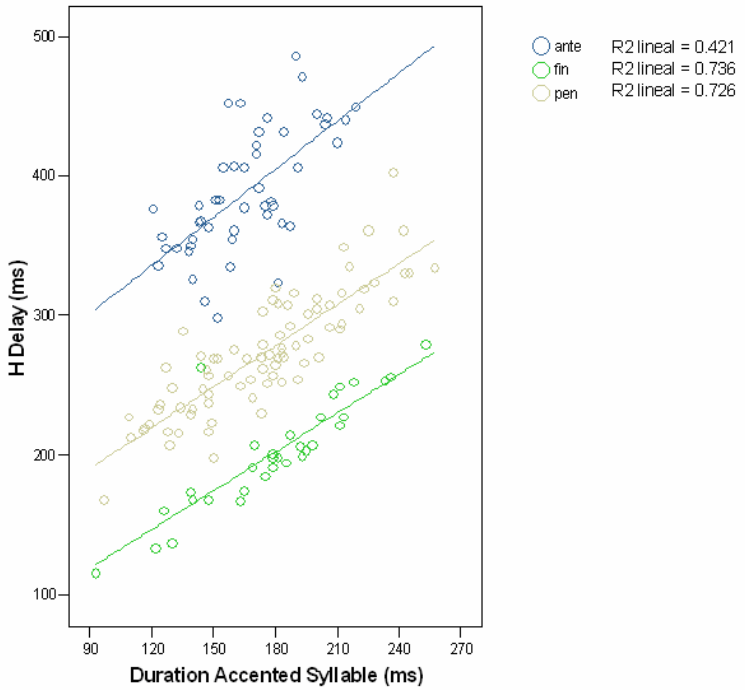

Figure 5. Peak delay (or distance between the onset of the accented syllable and the Fo peak) in ms as a function of the duration of the accented syllable in ms in three stress conditions (words with final, penultimate and antepenultimate stress) for the Spanish speaker DO.

3.2. Effects of the number of postaccentual syllables within the word on H location

The effects of the number of postaccentual syllables within the word on H location will be analysed in four different ways: 1) H peak delay (or distance to the beginning of the accented syllable) as a function of the number of postaccentual syllables; 2) H distance to the end of the accented syllable as a function of the number of postaccentual syllables; 3) H distance to the end of the postaccentual syllable as a function of the number of postaccentual syllables; and 4) H distance to the word boundary as a function of the number of postaccentual syllables.

3.2.1. H peak delay as a function of the number of postaccentual syllables within the word

The graph displayed in Figure 6 plots the mean H peak delay or distance in ms between the H peak relative to the beginning of the accented syllable in words with final, penultimate and antepenultimate stress for the Spanish (DO) and the English (KF) speakers. The results of the Spanish data show clear effects of the number of

postaccentual syllables within the word on H placement: peaks are less displaced in words with a final accent than in words with an accent on the penultimate syllable. Furthermore, words with an antepenultimate accent show a longer H delay than words with a penultimate accent. Thus, Fo peaks are more displaced in paroxytones than in oxytones and even more displaced in proparoxytones than in paroxytones. Conversely, the results of the English speaker exhibit a completely different behaviour since no effects of the number of postaccentual syllables are observed on H location. For all types of words the H shows a similar anchoring.

ANOVAs were done for the measure of H alignment relative to the beginning of the accented syllable for the two speakers. As expected, the ANOVAs revealed a significant effect of word boundary for the measures of peak delay for the Spanish speaker ($F(2, 86)=348{,}952$; $p<0{,}001$) but not for the English one ($F(2, 86)=0{,}426$; $p=0{,}654$). For the Spanish data, two-tailed t-tests comparing H alignment relative to the beginning of the accented syllable were performed in order to investigate whether the differences between fin/pen, pen/ante and fin/ante are also significant or not. The results of the t-tests showed significant differences in the three cases ($p<0.001$). Thus, whereas the Spanish data showed that peak location is affected by the number of postaccentual syllables within the word, the English data revealed no effects of the stress condition of the word on the position of the H.

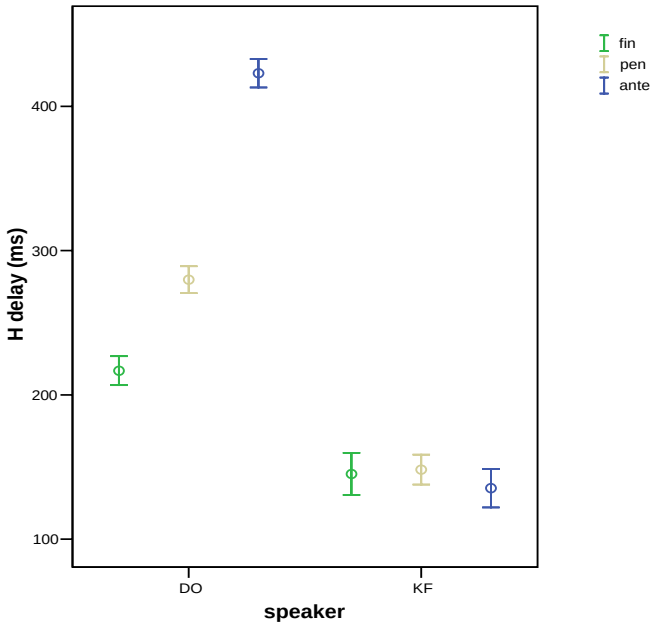

Figure 6. Mean H peak delay (or distance in ms between the H peak relative to the beginning of the accented syllable) as a function of the number of postaccentual syllables within the word for the Spanish speaker (DO) and the English speaker (KF): fin (words with a final accent), pen (words with a penultimate accent) and ante (words with an antepenultimate accent). The bars represent standard errors.

3.2.2. H distance to the end of the accented syllable as a function of the number of postaccentual syllables within the word

The results in Figure 7 show the distance in ms between the location of the H relative to the end of the accented syllable in words with final, penultimate and antepenultimate stress for the Spanish (DO) and the English (KF) speakers. Taking the 0 value as the end of the accented syllable, the plots show that for Spanish all Fo peaks are displaced to the postaccentual syllable or syllables, since all peaks are located beyond the 0 value. The results also show that in words with antepenultimate stress, Fo peaks are even more displaced than in words with penultimate stress. For English, on the other hand, the Fo peak is located within the accented syllable (i.e. before the 0 value) indicating that there is no displacement of the H in the postaccentual syllable/s.

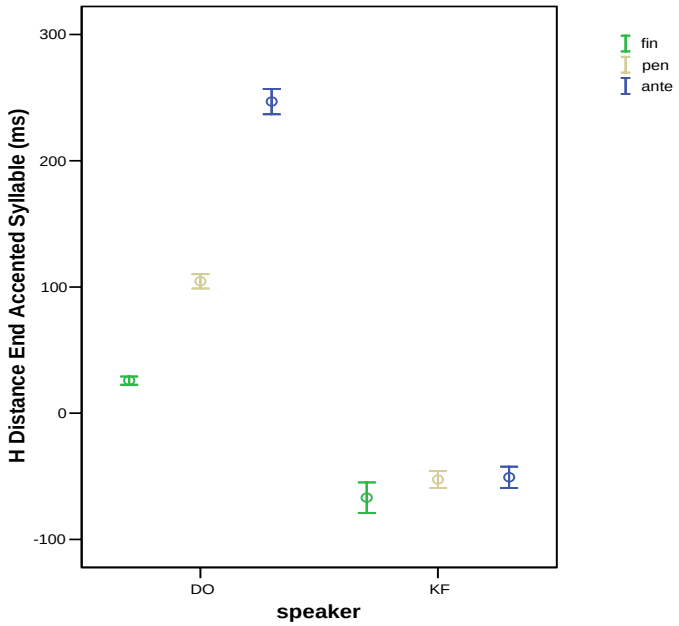

Figure 7. Mean distance in ms between the H peak relative to the end of the accented syllable as a function of the number of postaccentual syllables within the word for the Spanish speaker (DO) and the English speaker (KF). The bars represent standard errors.

ANOVAs were done for the measure of H alignment relative to the end of the accented syllable for the two speakers. As before, the ANOVAs revealed a significant effect of word boundary on peak distance to the offset of the accented syllable for the Spanish speaker ($F(2.\ 86)=780.654$; $p<0.001$) but no effects were found for the English speaker ($F(2.\ 86)=1.6$; $p=0.208$). Similarly, the results of two-tailed t-tests comparing H alignment relative to the end of the accented syllable in the stress conditions fin/pen, pen/ante and fin/ante in Spanish showed significant differences in the three cases ($p<0.001$).

In the English data, the consistent location of the H within the accented syllable despite the different stress conditions of the words clearly suggests an H* pitch accent anchored within the limits of the accented syllable. The results of the Spanish data, on the other hand, rule out the idea of an H* pitch accent since the H* notation indicates that the Fo peak is anchored within the accented syllable and in all the Spanish cases the Fo peak is located after the accented syllable. The clear differences in H alignment observed in the two languages also rule out the possibility of analysing prenuclear rises in English and in Spanish by means of the same tonal category with language-specific realisations, such as truncation or compression. The consistent location of the Fo peak in English within the accented syllable as opposed to the displaced Fo peak in Spanish suggests that we are facing two different phonological entities. The status of the Spanish H, however, is uncertain. Despite the clear effects of the number of postaccentual syllables on H alignment observed in the Spanish data, there is no strict anchoring of the H at the end of the word, since in words with final stress the Fo peak is located after the accented syllable. The possibility of analysing Spanish Fo peaks as instances of an H word-edge tone is further investigated in the next sections.

3.2.3. H distance to the end of the postaccentual syllable as a function of the number of postaccentual syllables within the word

The results presented in the previous sections showed that in the Spanish data the Fo peak is always located after the accented syllable regardless of stress. However, given the clear effects of the number of postaccentual syllables on the location of H and the greater Fo displacement in proparoxytones than in the other stress conditions, the alignment of H in relation to the offset of the postaccentual syllable was analysed so as to find out the exact anchoring of the Fo peak in this language. The results in Figure 8 show the distance in ms between the location of the H relative to the end of the postaccentual syllable in words with final, penultimate and antepenultimate accents for the Spanish (DO) and the English (KF) speakers. Taking the 0 value as the end of the postaccentual syllable, the results of the Spanish data show that in words with final and penultimate stress the Fo peak is anchored within the postaccentual syllable (i.e. before the 0 value). However, in proparoxytones the H is located after the postaccentual syllable. As expected no effects of number of postaccentual syllables on H alignment relative to the end of the postaccentual syllable were found for English.

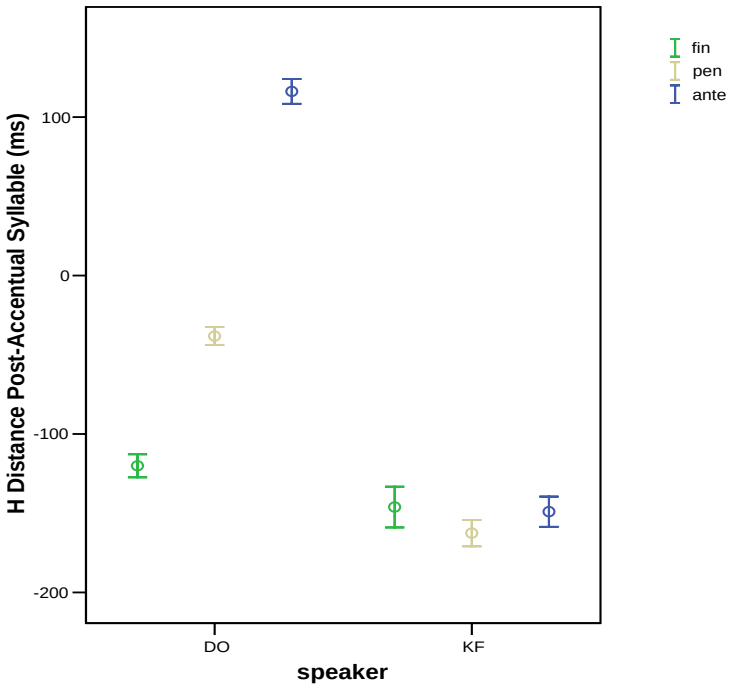

Figure 8. Mean distance in ms between the H peak relative to the end of the postaccentual syllable as a function of the number of postaccentual syllables within the word for the Spanish speaker (DO) and the English speaker (KF). The bars represent standard errors.

ANOVAs were done for the measure of H location relative to the end of the postaccentual syllable for the two speakers. The ANOVAs revealed a significant effect of word boundary on peak distance to the offset of the postaccentual syllable for the Spanish speaker ($F(2, 86)=963.459$; $p<0.001$) and no significant effects for the English speaker ($F(2. 86)=0.99$; $p=0.376$). As before, two-tailed t-tests comparing H location relative to the end of the postaccentual syllable in the stress conditions fin/pen, pen/ante and fin/ante were performed for Spanish. The results revealed significant differences ($p<0.001$) for the three groups.

These results corroborate the interpretation of Fo prenuclear rises in English as instances of an H* pitch accent aligned within the limits of the accented syllable and shed some more light on the phonological status of Spanish Fo rises. The clear location of the Fo peak after the postaccentual syllable in Spanish proparoxytones strengthens the evident effects of the number of postaccentual syllables within the word and suggests the possible presence of a loosely aligned H word-edge tone, that is, a word boundary tone to cue word boundaries although its location is not strictly fixed at the end of the word.

3.2.4. H distance to the word boundary as a function of the number of postaccentual syllables within the word

Finally, the location of H in relation to the end of the word was examined. The graph in Figure 9 plots the distance in ms between the H and the end of the word (0 value) in words with final, penultimate and antepenultimate stress for Spanish (speaker DO) and English (speaker KF). As expected, the results of the English data show that the F0 peak is always located before the end of the word (i.e. before the 0 value). Since in English the H is clearly aligned within the accented syllable, the H distance to the word boundary is greater in paroxytones than in oxytones and even greater in proparoxytones than in paroxytones, as a result of the different number of postaccentual syllables within the word. Thus, significant effects of the number of postaccentual syllables on the location of H relative to the word boundary were found for English ($F(2.86)=113.321$; $p<0.001$).

The results of the Spanish data show that in words with a final accent, the H is placed slightly after the end of the word. On the other hand, in words with a penultimate or an antepenultimate accent, the H is located slightly before the end of the word. Significant effects of the number of postaccentual syllables on H alignment relative to the word boundary were also found in Spanish ($F(2.159)=139.942$; $p<0.001$).

As in the previous sections, these results showed that even though there is no strict anchoring of H at the end of the word in Spanish prenuclear accents, there is a clear effect of the distance in syllables to the end of the word on H location. This seems to corroborate the idea of a loosely aligned word-edge tone.

Given the close location of the F0 peak at the end of words in Spanish, one could argue that the H is targeted at the end of the word and that the small differences in the alignment may reflect low-level effects. In order to test this hypothesis, I checked whether the small differences in the H alignment of oxytones, paroxytones and proparoxytones are significantly different from 0, that is, the end of the word. Two-tailed t-tests were carried out comparing the distance between 1) the beginning of the accented syllable/location of the H and 2) the beginning of the accented syllable/end of the word in the three stress conditions. The results of the t-tests showed that the differences observed in the data are not significant ($p>0.05$ in all cases). According to these findings, one may suggest that the H is phonologically targeted at the end of the word and, due to low-level effects, may be slightly delayed in some cases.

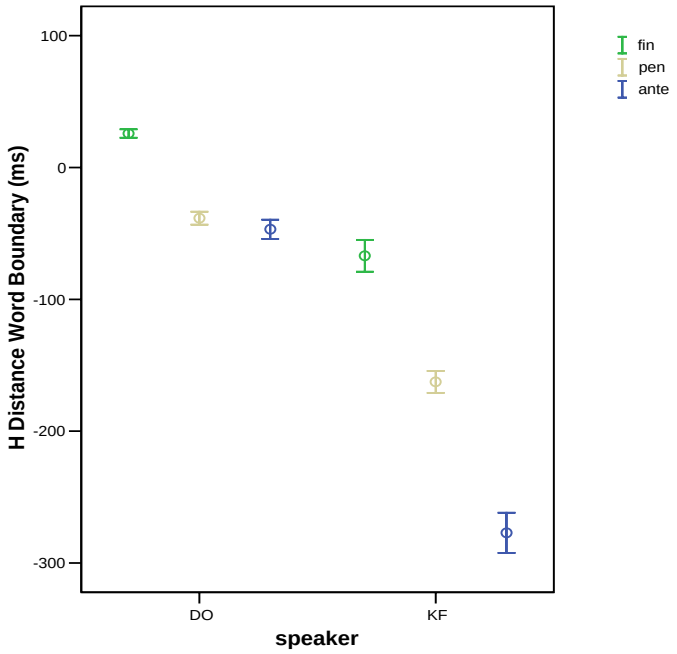

Figure 9. Mean values of distance between H peak location relative to the right edge of the word (in ms) as a function of the number of postaccentual syllables within the word for the Spanish speaker (DO) and the English speaker (KF). The bars represent standard errors.

4. Discussion

The results presented in this paper show that rising prenuclear accents should be accounted for by means of a High tone both in English and in Spanish. However, differences in the alignment of such accents show that two different phonological units may be used in the two languages. In English, the H tone corresponds to an H* pitch accent since the Fo peak is located within the limits of the accented syllable irrespective of the stress distribution of the word. These findings agree with previous work in English intonation (Pierrehumbert 1980; Ladd 1996, among others). In Spanish, on the other hand, the location of the H is always after the accented syllable, which is not consistent with the notion of an H* pitch accent, as proposed by Prieto, van Santen and Hirschberg (1994; 1995) and Nibert (2000). Furthermore, the H is clearly affected by the distance in syllables to the end of the word, namely the Fo peak is more displaced in paroxytones than in oxytones and even more displaced in proparoxytones than in paroxytones. This suggests the possibility of analysing such peaks as an H word-edge tone. This interpretation works fairly well for paroxytones and proparoxytones since in these words the Fo peak is always located on the last syllable of the word, namely the

postaccentual syllable in paroxytones and the syllable after the postaccentual one in proparoxytones. However, in oxytones the Fo peak is anchored after the last syllable of the word since in this case the last syllable is the accented one. Previous studies in Spanish intonation (Sosa 1999; Face 1999, 2001; Beckman *et al.* 2002; Calleja 2004) have accounted for such Fo movements as cases of L*+H. This accent clearly explains the fact of the Fo peak being located after the accented syllable. However, it fails to account for the effect of the stress condition on the location of the H. According to Grice (1995b), the trailing tone of a bitonal accent is fixed in time with respect to the starred one and this is not the behaviour found in Spanish prenuclear rises where the location of the Fo peak is affected by the number of postaccentual syllables within the word. Given these observations, I propose to account for Spanish prenuclear rising accents by means of an L* pitch accent followed by a loosely aligned H word-edge tone. In this respect, it has been observed that the accentual L in prenuclear accents is not always strictly aligned with the onset of the stressed syllable, especially when stressed patterns are varied. Thus, a similar behaviour can apply to the H accent. The H in Spanish seems to be phonologically targeted at the end of the word but it can be slightly delayed due to low-level effects. The presence of word-edge tones in declarative prenuclear accents has also been proposed in Estebas-Vilaplana (2000; 2003a; 2003b) for Central Catalan, in Pamies (2005) for the Spanish of Granada and in Estebas-Vilaplana (2006) for Castilian Spanish.

The different behaviour in H alignment observed in this paper for the two languages parallels the results reported in Solé (2007) for some segmental factors. She argues that adjustment of a certain phonetic dimension, such as VOT or nasalisation, to durational factors, such as speaking rate or differences in the number of syllables, suggests that the property is intended by the speaker and that the adjustment reflects an attempt to keep a constant perceptual distance across changes in durational factors. In the present data, the adjustments of the H peak to durational factors, that is, to differences in the number of postaccentual syllables observed in the Spanish sentences, suggest that the rise is phonologically targeted by the speaker and hence it should be described as a linguistically relevant category, such as an H word-edge tone, rather than as a language-specific realisation of H*.

5. Conclusion

In this paper the phonetic and phonological properties of English and Spanish prenuclear Fo rises in declarative sentences have been examined within the tenets of the AM approach. A production test was carried out in which I recorded English and Spanish declaratives containing words with different stress patterns (oxytones, paroxytones and proparoxytones) in prenuclear position. An acoustic analysis of the alignment patterns of the Fo peaks as a function of the number of postaccentual syllables within the word showed a clearly different behaviour in the two languages. Whereas in English the Fo peak was always anchored within the limits of the accented syllable regardless of the number of postaccentual syllables, in Spanish the location of the H was clearly affected by the distance in syllables to the end of the word. Thus, Fo

rising accents in English and Spanish seem to respond to two different phonological entities, namely an H* pitch accent for English and an H word-edge tone for Spanish.

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Appendix 1

ENGLISH SENTENCES

1) With prenuclear oxytones

John adores movies
The girls believe in fairies
The boys will present a paper
The jam remained in the jar
The nominee will win the award
Sam will sing a lullaby
Sue has learned modern languages
Lee relies on my money
Jim removed the garbage
Ron amends the bill
James has lived in Ireland
Pam will read the book
The referee will hire a hotel
The nun will arrive late
Neil will feed the baby

2) With prenuclear paroxytones

Nelly menaced the hostages
Norma managed the company
The neighbour balanced the disorder
The nanny is feeding the baby
The lady's reading the book
My mother is living in Ireland
Brenda polished the shoes
Mary's learning modern languages
Molly's removing the garbage
Minnie's singing a lullaby
Johnny mentioned the solution
The lawyer favoured the poor
Julie's presented a paper
The German finished the speech
Lizzy's arriving late

3) With prenuclear proparoxytones

Melanie's menacing the hostages
Jeremy manages his company

The journalist balances the disorder
The minister moderates the audience
Jonathan memorised the names
Valerie normalised the numbers
Josephine is polishing the shoes
Emily damages the window
Marjory executes the task

The murderer telephoned the police
Caroline modified the route
The president is favouring the poor
The Mexican is finishing the speech
The gentleman is mentioning the solution
The matchmaker meditates the case

Appendix 2

SPANISH SENTENCES

1) With prenuclear oxytones

Mamá le miró la mano
Ramón mimó la nena
El camión resultó enorme
El avión voló sobre el mar
Julián manejó el ordenador
El ladrón robó la camioneta
El señor nominó al candidato
El doctor le curó el dedo
El barón compró la moneda
El jarrón apareció roto
El balcón está en el caserío
El tejón comió la mandarina
El folletón fomentó la lectura
El cardenal llenó la iglesia
Rubén marinó el salmón

2) With prenuclear paroxytones

La nena le miraba la mano
La niña mimaba la nena
El nombre resultaba enorme
El ángel volaba sobre el mar
Marina manejaba el ordenador
La ladrona robaba la camioneta
La señora nominaba al candidato

La doctora le curaba el dedo
La baronesa compraba la moneda
La mesa parecía rota
La sala estaba en el caserío
El mono comía la mandarina
El libro fomentaba la lectura
El cura llenaba la iglesia
Romina marinaba el salmón

3) With prenuclear proparoxytones

Melanie mirábale la mano
Mónica mimábale la nena
El número resultábale enorme
Los ángeles volábamos sobre el mar
Ángela manejábale el ordenador
El nómada robábale la camioneta
La árbitro nominábale el candidato
El podólogo curábale el dedo
El náufrago comprábale la moneda
La lámpara parecíale rota
La bóveda ensuciábale el caserío
El pájaro comíale la mandarina
La página fomentábale la lectura
El santísimo llenábale la iglesia
La máquina marinábale el salmón

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