

Focus and early peak alignment in Spanish intonation¹

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Abstract

Recent work on Spanish intonation has shown that words in narrow focus often have an F0 peak within the stressed syllable, while when not in focus the peak generally follows the stressed syllable. Agreement has not been reached, however, as to an appropriate phonological analysis of this intonation pattern. It is shown here that this early F0 peak is the result of a focal pitch accent rather than the phonetic effect of a following intermediate phrase boundary. In addition, it is shown that this is not the only strategy in Spanish for conveying narrow focus through intonation, as increased F0 peak height may also be used. While either strategy may be used to convey focus in different positions within an utterance, there is a difference in frequency which is explained based on the ability to counteract downstep in all positions except initial position, where there is no previous peak from which to downstep.

1. Introduction

Until recently, the study of Spanish intonation has trailed behind the study of other areas of Spanish phonetics and phonology, receiving only occasional mention. While Navarro Tomás (1944) conducted pioneering research on Spanish intonation, this work did not spur the type of follow-up studies and further investigation by other scholars that often follows groundbreaking work in a new area of study. In fact, it was not until the emergence of Pierrehumbert's (1980) autosegmental-metrical (AM) approach to intonation, which was further developed by Pierrehumbert and her colleagues (see especially Beckman and Pierrehumbert 1986, Beckman and Ayers 1994, Pierrehumbert and Beckman 1988; see Ladd 1996 for a summary), that studies on Spanish intonation started to become more frequent. Since

1. I wish to thank an anonymous reviewer whose thorough and extremely helpful advice on an earlier draft made a tremendous contribution to this paper. Any errors remain mine.

the introduction of the AM framework, Spanish intonation has been a growing area of discussion within Spanish phonetics and phonology, both within the AM framework and within other models (Alcoba and Murillo 1998; Face *in press*; Fant 1984; Garrido et al. 1993, 1995; Hualde 2000; Llisterri et al. 1995; Prieto 1998; Prieto and Shih 1995; Prieto et al. 1995, 1996; Sosa 1991, 1999; Willis 2000). While this increase in the phonetic and phonological work on Spanish intonation has led to a better understanding of the Spanish intonational system, it has also raised a number of questions for further investigation. In this paper I address one of these questions that has been the topic of recent debate: the analysis of early peak alignment in Spanish.

Since Navarro Tomás (1944) scholars have observed that the fundamental frequency (F0) rises throughout stressed syllables in Spanish, but that the F0 peak is quite frequently realized on the posttonic syllable (Face *in press*; Fant 1984; Garrido et al. 1993; Llisterri et al. 1995; Prieto et al. 1995; Sosa 1991, 1999). In fact, Garrido et al.'s (1993) quantitative study shows that Spanish F0 peaks are realized on the posttonic syllable over 70 % of the time.

It has recently been shown, however, that there are particular cases where the F0 peak is generally realized on the stressed syllable rather than on the posttonic syllable. Llisterri et al. (1995) and Face (*in press*) show that this is the case for the final F0 peak of a sentence, and de la Mota (1997) shows that this is the norm for the F0 peak associated with the stressed syllable of a word in narrow focus. While these observations are now commonly accepted by scholars, there is much debate as to the appropriate phonological analysis to account for the observed patterns. In the present study I present evidence which shows that only one of two competing analyses of early peak alignment can be maintained.

Using a similar methodology to that used in the present study, Face (*in press*) showed that in broad focus declaratives the location of the F0 peak was a direct result of the number of immediately following unstressed syllables before the next stressed syllable. As soon as there was even one following unstressed syllable, there was a heavy preference for the F0 peak to occur after the stressed syllable, and as more following unstressed syllables were added the tendency became even stronger. Since no such study has been carried out with words in focus, this is the first issue to be examined here. While de la Mota (1997) reports that F0 peaks generally occur within the stressed syllable of focused words, this must be confirmed in the data collected for the present study. If there is a notable peak alignment difference between focused and unfocused words as de la Mota's (1997) data indicate, then analyzing that alignment difference is of great importance. On the other hand, if de la Mota's (1997) findings are not confirmed by the present study, then accounting for early alignment of F0 peaks in pre-final position is a non-issue.

This paper is organized as follows: In the following section I discuss the previous analyses of rising pitch accents in Spanish with emphasis on the two competing analyses for early F0 peak alignment in words in narrow focus. Section 3 details the methods of the experiment carried out for the present study. In sec-

tion 4 I present the experimental results and a discussion of them. Section 5 is a further discussion of related issues. Finally, the last section contains some concluding comments on the contribution of this investigation to the study of Spanish intonation and mentions topics for further research.

2. Previous analyses of rising pitch accents in Spanish

The number of scholars cited above who have observed the F0 peak alignment patterns of Spanish is much greater than the number who have attempted to provide a phonological analysis of these patterns. The phonological analyses that have been proposed can be divided into two categories: (1) those that claim that the F0 peak alignment differences (i.e., early vs. late peak alignment, see below) are attributable to different phonological pitch accents and (2) those that claim that there is only one rising pitch accent, but that its F0 peak is realized differently due to other factors. Face (in press), Sosa (1999) and Willis (2000) argue for the first analysis, while Hualde (2000), Nibert (2000) and Prieto (1998; Prieto et al. 1995, 1996) argue for the second. It must be stated here precisely what is meant by the terms “early peak alignment” and “late peak alignment”. By “early peak alignment” I refer to the realization of the F0 peak within the stressed syllable, while by “late peak alignment” I refer to its realization in a posttonic syllable.²

Nibert (2000) and Prieto (1998; Prieto et al. 1995, 1996) claim that there is only one phonological pitch accent in Spanish, and propose that it be represented as H*. In these analyses, early vs. late F0 peak alignment is not due to a phonological difference in pitch accent, but rather to other factors influencing the realization of the F0 peak. In the case of early F0 peak alignment in the final pitch accent of a sentence, these authors claim that the F0 peak is realized early due to the quickly upcoming low boundary tone L%, as is assumed in Llisterri et al.’s (1995) purely phonetic study. While Prieto offers no explanation for early peak alignment in other positions within the sentence (e.g., words in narrow focus), Nibert (2000) claims that there is an intermediate phrase boundary L- immediately following the H* associated with the stressed syllable of the word in narrow focus, and that this L- causes the F0 peak of the H* to be realized earlier than it otherwise would be. These two analyses are demonstrated in (1) for the sentence *Que lo terminó Nana ayer* ‘That Nana finished it yesterday’, where *terminó* ‘finished’ is in narrow focus.

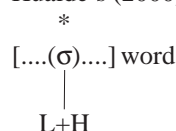
2. An anonymous reviewer points out that this is a binary distinction while measurements of F0 peak location are continuous in terms of ms. While I argue for a binary distinction caused by the use of two different pitch accents, a continuous measurement is necessary in order to examine whether the exact realization of the F0 peak in words in narrow focus is affected by the distance between stressed syllables, as is the case in words in broad focus (Face in press).

(1) Two analyses of a sentence with narrow focus

- a. Prieto: H* H* H* L%
 Que lo terminó N a na aye r. ‘That Nana finished it yesterday’
- b. Nibert: H* L- H* H* L%

Hualde (2000) agrees with Nibert (2000) and Prieto (1998; Prieto et al. 1995, 1996) in claiming that there is only one phonological pitch accent in Spanish, which he represents as (L+H)*. Rather than placing a star on either of the individual tones, he stars the syllable to which the L+H sequence associates, as in (2).

(2) Hualde’s (2000) representation of the Spanish rising pitch accent



While the starring of the syllable may have theoretical implications, they are beyond the scope of the present study and will not be considered. What is pertinent for present purposes is that Hualde (2000) claims that there is only one phonological rising pitch accent in Spanish.

Against this view, Face (in press) and Sosa (1999) claim that there are two phonological rising pitch accents in Spanish. Both scholars propose L*+H for late F0 peak alignment. This notation accounts for the aforementioned observation that F0 peaks are generally realized on the posttonic syllable in Spanish. The unstarred H means that while it is affiliated with the stressed syllable, it is not associated with it. This lack of association allows the F0 peak to be realized on the posttonic syllable. Sosa (1999) proposes L* in some cases and H* in others to account for early F0 peak alignment in the final pitch accent of a sentence, but Face (in press) and Hualde (2000) both show convincingly that not even Sosa’s own data support his analysis of L* and H*. Face (in press) argues that the correct analysis of this early F0 peak alignment in sentence final position is a L+H* pitch accent. This differs from the late alignment L*+H in that the H is starred, and is therefore associated with the stressed syllable. This explains the realization of the F0 peak on the stressed syllable rather than on the posttonic syllable. Face (in press) also presents preliminary evidence for L+H* outside of final position on words in narrow focus, taking into account the alignment patterns for focus noted by de la Mota (1997). Further evidence for L+H* outside of final position is presented by Willis (2000) for imperatives.

The studies by Face (in press) and Hualde (2000) are the most relevant for the present study, though they in turn draw on the other studies referred to above. Both Face (in press) and Hualde (2000) present convincing evidence that all rising pitch accents in Spanish must be represented by a L+H sequence of some sort. While

Hualde (2000) claims that all rising pitch accents are (L+H)*, Face (in press) argues that both L*+H and L+H* exist. Neither of these studies, however, is strong enough to decisively refute the competing analysis. Face (in press) presents strong evidence for early F0 peak alignment in sentence-final pitch accents, and while his data would seem to support a different phonological pitch accent, other interpretations are possible, as Hualde (2000) points out. The primary weakness of Face's (in press) study is that only preliminary evidence is given for L+H* outside of sentence-final position. Without strong evidence for L+H* in pre-final position, the upcoming L% can be claimed to affect the F0 peak alignment in sentence-final pitch accents.

Hualde (2000), on the other hand, offers an analysis, following Nibert (2000), which argues that early F0 peak alignment in pre-final position is accounted for by a L- following the H of the (L+H)* pitch accent, making early F0 peak alignment in pre-final position attributable to an effect of this intermediate phrase boundary. While Hualde's (2000) study offers an alternative analysis to Face (in press), he does not present data showing that it is the correct analysis, or even preferable on theoretical grounds. This lack of evidence is particularly problematic in an analysis of Spanish intonation as there is much debate as to whether Spanish even has intermediate phrases (Nibert 1999, 2000; Sosa 1991, 1999).

While Face (in press) and Hualde (2000) are equally able to account for the early F0 peak alignment in sentence-final position, though by different mechanisms, neither presents convincing evidence for the analysis of early F0 peak alignment in pre-final position. In order to resolve the debate over whether there are one or two phonological rising pitch accents in Spanish, the present study examines early F0 peak alignment in pre-final position. In order to do so I contrast words in narrow focus, which de la Mota (1997) reports generally to have early F0 peak alignment, and broad focus. In this study "narrow focus" refers to contrastive focus on an individual word while "broad focus" refers to a news reading where the entire sentence is new information with no individual word being more prominent than another. An example of each of these can be seen in (3).

- (3) Examples of narrow focus and broad focus.
 - a. Narrow focus (focused word in capitals)
 - *Did John go to the store?*
 - *MARY went to the store.*
 - b. Broad focus
 - *What happened?*
 - *Mary went to the store.*

The intonational aspects of narrow focus are examined in comparison to those of broad focus in order to provide a better understanding of the role of intonation in marking narrow focus. The data presented do not merely provide an explanation of the intonation of narrow focus, but additionally make a significant contribution

to the question of the number of rising pitch accents in Spanish, offering strong evidence for two phonologically distinct rising pitch accents.

3. Methods

In order to investigate the intonational patterns associated with words in narrow focus, a corpus of target sentences and contexts was created. The corpus consisted of two sets of target sentences, and each target sentence consisted of three stressed words. Within each set of target sentences, the first stressed syllable of each sentence was segmentally identical to the others, as was the second stressed syllable of each sentence within a set. Within each set the number of intervening unstressed syllables was varied so that there were between 0 and 5 unstressed syllables between the first two stressed syllables.³

Each target sentence and its context constituted a four-line dialogue. Each dialogue began with a question forcing its answer to be produced in broad focus. Since the purpose of the present study is to investigate the effects of narrow focus on the intonation pattern of pre-final words, the third line of the dialogue was a clarification question with either the first or second of the three stressed words incorrect. This required a repetition of the response to the first question, but this time with narrow focus on the word which was being corrected. Therefore each dialogue produced the target sentence both in broad focus and with one pre-final stressed word in narrow focus. For each target sentence there were two dialogues: one requiring focus on the first stressed word of the target sentence and one requiring focus on the second stressed word. In all, then, there were 24 dialogues (2 sets \times 6 target sentences \times 2 focus patterns = 24). An example dialogue is given in (4), and the entire corpus is given in the appendix.

- (4) Example dialogue from the experiment (target stressed syllables are underlined, and the focused word is in capitals)
- | | |
|---|---|
| A: ¿ <u>Qué</u> dijo Mario? | 'What did Mario say?' |
| B: <u>Que terminó</u> la <u>banana</u> de la chica. | 'That he finished the girl's banana' |
| A: ¿ <u>Que terminó</u> la <u>manzana</u> de la chica? | 'That he finished the girl's apple?' |
| B: No. <u>Que terminó</u> la <u>BANANA</u> de la chica. | 'No. That he finished the girl's banana.' |

3. The first two of the three stressed syllables were the target of the investigation since one of the major goals of the study is to examine whether narrow focus causes early alignment of the F0 peak in pre-final position. Llisterri et al. (1995) and Face (in press) have shown that the stressed syllable of the final word of an utterance has an early F0 peak when produced with broad focus, making it of no use in a study examining the contrast between early F0 peak alignment in narrowly focused words and late F0 peak alignment in words produced with broad focus.

The corpus of 24 dialogues was recorded by two female and one male subject from Madrid, Spain, who are in their late twenties or early thirties. The portion of the dialogue not containing target sentences (i.e., speaker A in the dialogue in (2)) was read by another native speaker of the same dialect. Each speaker recorded the corpus twice, each time in a different random order. This produced a total of 288 target sentences for the analysis ($24 \text{ dialogues} \times 2 \text{ repetitions} \times 2 \text{ target sentences per dialogue} \times 3 \text{ speakers} = 288$). The speakers were recorded in an anechoic chamber with a Marantz PMD 222 tape recorder and a Shure SM10A head-mount microphone. Digitization and analysis of the recordings were carried out using the PitchWorks software package, which was designed specifically for studies of intonation.

Measurements of the duration of each target stressed syllable as well as the location and depth of the F0 valley and the location and height of the F0 peak associated with each target stressed syllable were made. Derivable from these measurements was the duration of the F0 rise associated with each target stressed syllable. Measurements for F0 valleys were made in the deepest part of the valley and with regard to the beginning of the stressed syllable, while measurements for F0 peaks were made at the highest part of the peak and with regard to the end of the stressed syllable. In the few cases where there were plateaus rather than clear peaks or valleys, the measurement was made at the elbow in the pitch contour (i.e., the edge of the plateau closest to the F0 rise).

4. Results and discussion

4.1. F0 peak location

4.1.1. Effects of the number of intervening syllables. In Table 1, the location of the F0 peak for the first of the two target stressed syllables in both broad and narrow focus words is presented for various numbers of intervening unstressed syllables. The location is measured in temporal distance from the end of the first target stressed syllable.

The data for broad focus in Table 1 are consistent with the data presented in Face (in press), and noted by numerous other scholars as mentioned above, viz., there is a strong preference for the F0 peak to occur after the stressed syllable. Only in stress clash situations is the peak forced to be realized on the stressed syllable. Example pitch tracks of sentences in broad focus are given in Figure 1, where it can be seen that the pre-final F0 peaks are realized after the stressed syllable.

The results in Table 1 for narrow focus are quite different. Here the F0 peak is almost always realized on the stressed syllable when there are two or fewer unstressed syllables intervening between the two target stressed syllables. When there are more than two intervening unstressed syllables the F0 peak is still realized on the stressed syllable half of the time. Example pitch tracks of the same

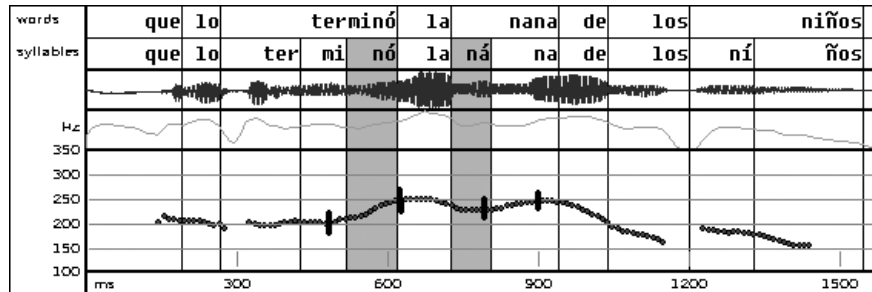
Table 1. F0 peak alignment in broad and narrow focus

		Intervening Unstressed Syllables	0	1	2	3	4	5
BROAD FOCUS n=24 per column	% of peaks within the stressed syllable		79 %	17 %	4 %	0 %	4 %	0 %
	Average		–12.4 ms	30.8 ms	52.4 ms	95.7 ms	67.8 ms	98 ms
	location of the F0 peak	SE = 5.4 ms	SE = 8.4 ms	SE = 6.2 ms	SE = 8.5 ms	SE = 7.4 ms	SE = 5.6 ms	
NARROW FOCUS n=12 per column	% of peaks within the stressed syllable		92 %	92 %	92 %	58 %	42 %	50 %
	Average		–31.3 ms	–33 ms	–7.8 ms	10.9 ms	21.3 ms	13.3 ms
	location of the F0 peak	SE = 3.5 ms	SE = 19.9 ms	SE = 19.8 ms	SE = 23.7 ms	SE = 22.4 ms	SE = 24.7 ms	

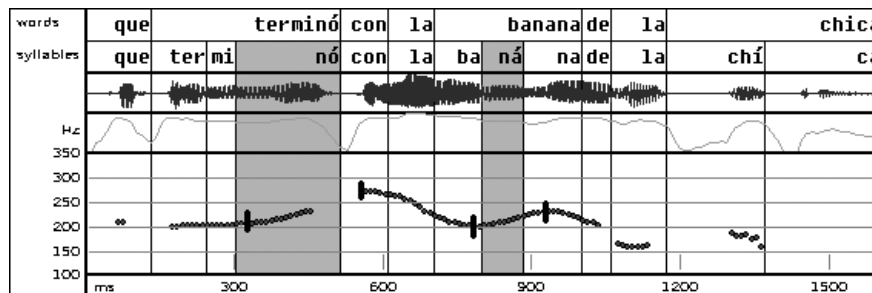
sentences as in Figure 1, but with narrow focus on the first content word of the sentence, are given in Figure 2. These data for narrow focus contrast with the data for broad focus, as is evidenced by the results of an ANOVA which shows that for all data focus type (i.e., broad or narrow) has a highly significant effect ($p < .01$) on the location of the corresponding F0 peak, with the mean location being 4.4 ms before the end of the stressed syllable in the case of narrow focus and 55.3 ms after the stressed syllable in the case of broad focus. With regard to the effect of the number of intervening unstressed syllables on F0 peak realization, ANOVAs show that this effect is highly significant in the broad focus cases, but not significant in the narrow focus cases ($p = .26$). This diminished effect in the narrow focus cases can be attributed to the F0 peak's stronger tie to the stressed syllable, and therefore its reduced possibilities of entering into tonal crowding with the pitch accent associated with the following stressed syllable. The nature of this tie to the stressed syllable will be the topic of discussion below.

The clear F0 peak alignment difference between broad and narrow focus is consistent with the findings of de la Mota (1997), and makes clear the need for an account of early peak alignment in pre-sentence-final position. Since Face (in press) and Hualde (2000) disagree on a phonological account of early F0 peak alignment, and neither present more than anecdotal evidence from early peak alignment in pre-final position, a detailed examination of pre-final early peak alignment is nec-

a. One intervening unstressed syllable



b. Three intervening unstressed syllables



c. Five intervening unstressed syllables

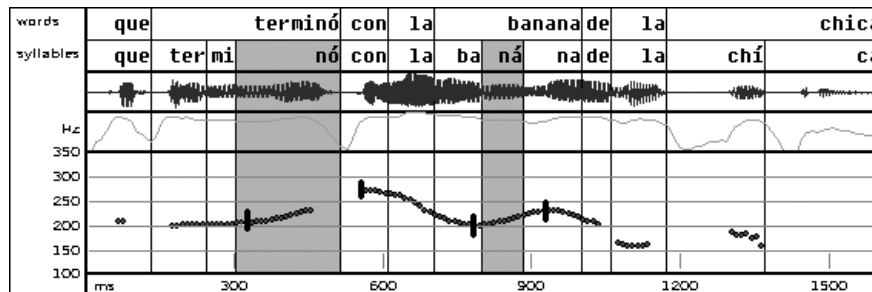
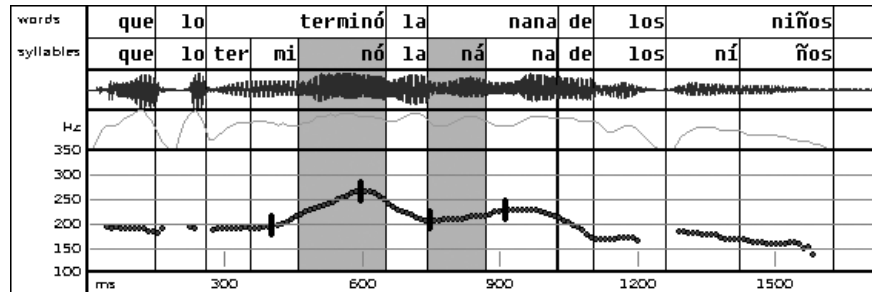


Figure 1. Example pitch tracks of broad focus sentences. Target stressed syllables are shaded and F0 measurement points are marked with vertical black lines.

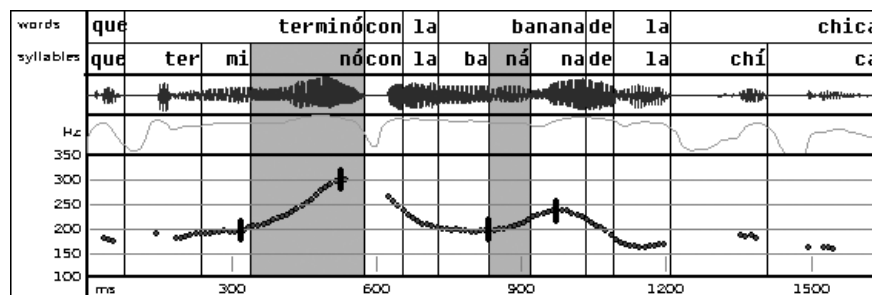
essary in order to reach a conclusion as to the number of rising pitch accents in Spanish.

4.1.2. *First vs. second stressed word.* Face (2000) found that the prosodic manifestations of focus can differ based upon the position of the focused word within

a. One intervening unstressed syllable



b. Three intervening unstressed syllables



c. Five intervening unstressed syllables

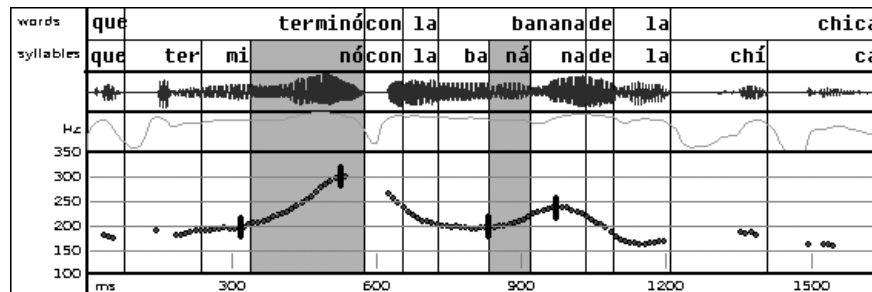


Figure 2. Example pitch tracks of sentences with the first stressed word in narrow focus. Target stressed syllables are shaded and F0 measurement points are marked with vertical black lines.

the sentence. This difference in behavior by position motivates looking at the alignment patterns of the F0 peak associated with the second target stressed syllable in the present study. For the purpose of comparison of the F0 peak alignment of the first and second target stressed syllables, the data from Table 1 are combined

Table 2. F0 peak alignment by position

		1st Position	2nd Position
BROAD FOCUS n=144 per column	% of peaks within the stressed syllable	17 %	8 %
	Average location of the F0 peak	55.3 ms SE = 5 ms	62.3 ms SE = 4.6 ms
NARROW FOCUS n=72 per column	% of peaks within the stressed syllable	71 %	40 %
	Average location of the F0 peak	-4.4 ms SE = 8.4 ms	42.5 ms SE = 7.6 ms
Probability (ANOVA)		p<.01	p=.01

in Table 2 and the new data from the second target stressed syllable is added.⁴

The data in Table 2 show that in the second target stressed syllable (always the second stressed syllable of the sentence), there is much more likelihood that the F0 peak will be realized after the stressed syllable when it is in narrow focus than is the case for the first target stressed syllable. This raises the question as to why early F0 peak alignment in narrowly focused words is more likely in initial position. Face (2000) observes a similar difference by position with regard to F0 peak height.

4.2. F0 peak height

Face (2000) notes that the F0 peak height associated with narrowly focused words is not higher than that associated with words in broad focus in initial position, but that it is higher in other positions. A similar pattern is found in the present study. Table 3 presents data showing the average F0 peak height by position.

The data in Table 3 further support Face's (2000) findings that the prosodic manifestations of focus vary by the position of the focused word within the sentence. Focus is not a statistically significant factor in determining F0 peak height in initial position, while it is a statistically significant factor in non-initial position. In

4. Since the controlled distance between stressed syllables is between the first and second of each utterance rather than between the second and third, the same breakdown of the effects of the number of intervening unstressed syllables as was seen in Table 1 for the first F0 peak is impossible for the second F0 peak. For this reason the data from Table 1 is collapsed in order to be compared with the results for the second F0 peak in Table 2.

Table 3. F0 peak height by focus type and position

	1st Position	2nd Position
BROAD FOCUS	202 Hz	184.1 Hz
n=144 per column	SE = 4.1 Hz	SE = 3.8 Hz
NARROW FOCUS	204.8 Hz	198.8 Hz
n=72 per column	SE = 6 Hz	SE = 5.4 Hz
Probability (ANOVA)	p=.64	p=.01

combination with the data in Table 2, this indicates that both F0 peak alignment and F0 peak height play a role in conveying focus.

An explanation for why peak location is used more frequently in initial position and peak height in non-initial position can be found in previous work on downstep in Spanish (Prieto 1998; Prieto et al. 1995, 1996). Since F0 peaks become subsequently lower throughout an utterance, the presence of a higher peak where a downstepped peak would be expected would be a salient prosodic marker of focus for the listener. In initial position, however, there is no preceding peak from which the initial peak can be downstepped, making a distinction based on F0 peak height less salient than one based on F0 peak alignment. While both strategies can be used in initial and non-initial position, F0 peak alignment is used more often in initial position where there is no downstepping to be counteracted, while F0 peak height is used more often in non-initial position where downstepping can be counteracted.

While the data shown to this point confirm that F0 peak alignment is used to convey narrow focus and offer an important insight into the coordinated use of F0 peak alignment and F0 peak height in the prosodic conveyance of narrow focus, it is now necessary to directly address the question of whether the early F0 peak alignment in words in narrow focus is due to a different pitch accent as Face (in press) claims or whether it is due to an intermediate phrase boundary following the focused word as Hualde (2000) and Nibert (2000) claim. As stated previously, either analysis could account for early F0 peak alignment, and therefore it is crucial to look in detail at the tonal patterns involved with narrow focus.

4.3. F0 valley location

4.3.1. Post-focal F0 valley. Since either of the aforementioned analyses can account for the early F0 peak alignment in words in narrow focus, further examination of the F0 peak would prove fruitless. The claim by Hualde (2000) and Nibert (2000) that the pitch accent of the focused word is followed by an intermediate phrase boundary L-, on the other hand, is certainly able to be investigated.

Table 4. Height of F0 peaks in first position

NARROW FOCUS EARLY F0 PEAKS n=45	189.8 Hz SE = 7 Hz
NARROW FOCUS LATE F0 PEAKS n=27	229.9 Hz SE = 9.1 Hz
BROAD FOCUS n=144	202 Hz SE = 4 Hz
Probability (ANOVA)	p<.01

If a L- occurs after the word in focus, then the F0 valley following the early peak should be realized at the end of that word. If there is no L-, on the other hand, then the following F0 valley would be the result of the L of the next pitch accent. In this case the F0 valley would not be realized at the end of the focused word, but rather at or near the beginning of the next stressed syllable. Since early F0 peak alignment is most common in initial position, it is the first target stressed syllable and the following F0 valley that I examine to address this issue. This also provides the opportunity to take advantage of the controlled number of intervening syllables between the first and second stressed syllables in order to be sure that only those cases where there is enough phonetic space for the F0 valley to be moved around by the speaker are considered.

In order to examine cases where the F0 valley has enough phonetic space to be moved around, only those cases where there are at least two intervening unstressed syllables are considered. In these cases the average location of the post-focal F0 valley is 11.2 ms (SE = 3.7 ms) before the following stressed syllable. It is important to note that in the cases used in this calculation, in no case was the edge of the word in narrow focus adjacent to the second target stressed syllable, making it clear that the reason for the alignment of the post-focal F0 valley just before the second target stressed syllable is not ambiguous, but must be due to it being the realization of the L of the pitch accent associated with the second target stressed syllable. Nonetheless, by limiting the cases considered to those where there are at least two intervening unstressed syllables, the percentage of cases considered which do not have an F0 peak within the stressed syllable is greatly increased (cf. Table 1). In the cases which do not have an early F0 peak, the other strategy observed above for marking narrow focus is employed, viz. a higher F0 peak. This is evidenced by the data in Table 4 which show that for the narrow focus data in Table 1, late aligned F0 peaks average 40 ms higher than early aligned F0 peaks, and 27 ms higher than broad focus peaks in the same position. Hualde (2000) and Nibert's (2000) analyses do not predict a L- in these cases, so in order to confirm this result, these cases must be removed from consideration.

In order to validate the claim that the post-focal F0 valley is aligned with the following stressed syllable in cases of early peak alignment, the cases where the F0 peak occurred outside of the stressed syllable were eliminated from consideration and the average location of the post-focal F0 valley was recalculated. The results were that in cases of early F0 peak alignment with two or more intervening unstressed syllables, the average location of the F0 valley is 16.5 ms (SE = 5.3 ms) before the beginning of the following stressed syllable, confirming that the F0 valley is part of the pitch accent rather than the realization of a L- at the end of the word in narrow focus.

These data provide crucial evidence against the L- analysis offered by Hualde (2000) and Nibert (2000) since this analysis predicts an F0 valley at the edge of the narrowly focused word. Examples demonstrating the alignment of the post-focal F0 valley with the second target stressed syllable can be seen in Figure 2. Here it is clear that the F0 valley is not realized at the right edge of the narrowly focused word, but is aligned with the beginning of the next stressed syllable.

The importance of this finding for a phonological analysis of Spanish intonation should not be overlooked. Despite the increase in work on Spanish intonation, accounting for early F0 peak alignment has been a highly debated issue. The data presented here exclude an intermediate phrase boundary L- as an explanation for early F0 peak alignment, showing that the F0 valley which follows is part of the following pitch accent. This means that there are no tonal specifications of any kind between the H of the focal pitch accent and the L of the following pitch accent, and the early F0 peak alignment must be the result of a focal pitch accent phonologically distinct from the non-focal pitch accent.

4.3.2. First vs. second position. While the data reported in the previous sections seem to indicate that Spanish has two phonological rising pitch accents, there is an important question which remains to be answered: What is the correct analysis of these two pitch accents? Face (in press) and Sosa (1999) show clearly that L*+H is the correct analysis of the non-focal pitch accent. Face (in press) proposes that the pitch accent responsible for early F0 peak alignment be labeled L+H*, accounting for the F0 peak being realized within the stressed syllable.

While this seems to be a logical distinction, Face (in press) notes that the F0 valley as well as the F0 peak seems to be aligned with the stressed syllable in cases of early F0 peak alignment. This same observation is made based on the data from the present study. Table 5 shows that the average location of the F0 valley, measured in temporal distance from the beginning of the target stressed syllable, is not significantly different between words in broad and narrow focus.

This indicates that for the focal pitch accent the L is aligned to the stressed syllable just as it is in the L*+H pitch accent. The general implication is that the difference between the two pitch accents is the patterning of the H and that the L is aligned with the stressed syllable in both cases. Therefore L*+H is appropriate

Table 5. Average location of F0 valley by focus type and position

	1st Position	2nd Position
BROAD FOCUS n=144 per column	−8.5 ms SE = 1.4 ms	15.6 ms SE = 2.9 ms
NARROW FOCUS n=72 per column	−9.2 ms SE = 2 ms	0.2 ms SE = 4 ms
Probability (ANOVA)	p=.76	p=.16

Table 6. Average depth of F0 valley by focus type and position

	1st Position	2nd Position
BROAD FOCUS n=144 per column	161.3 Hz SE = 3.1 Hz	166.2 Hz SE = 3.4 Hz
NARROW FOCUS n=72 per column	153.4 Hz SE = 4.4 Hz	158.1 Hz SE = 4.7 Hz
Probability (ANOVA)	p=.14	p=.20

as proposed by Face (in press) and Sosa (1999), but L+H* as proposed by Face (in press) does not reflect the alignment of the L to the stressed syllable. While L+H* captures the difference in peak alignment, it also predicts a difference in valley alignment. A more accurate representation of the pitch accent causing early F0 peak alignment is (L+H)*, which indicates the alignment of both tones to the stressed syllable. It is interesting to note that Frota (1998) observes a similar alignment difference between leading and trailing tones in Portuguese.

4.4. F0 valley depth

While the location of the F0 valley with regard to the beginning of the stressed syllable is not affected by narrow focus, the question remains as to whether the depth of the F0 valley may be affected. Table 6 shows the results for the F0 valley of the pitch accent associated with each position in both broad and narrow focus.

These results indicate that there is not a significant difference in the depth of F0 valleys associated with the stressed syllable of words in broad and narrow focus. Besides considering the possible effects that narrow focus may have on the depth of the F0 valley associated with the stressed syllable of the focus word, there is the possibility that focus may affect the depth of the following F0 valley. Table 7 shows, however, that there is no such effect.

Table 7. Depth of post-focal F0 valley by focus type

BROAD FOCUS n=144	166.2 Hz SE = 3.3 Hz
NARROW FOCUS n=72	162.3 Hz SE = 4.9 Hz
Probability (ANOVA)	p=.51

4.5. Duration

While the data in the above sections seem to indicate that the tonal alignment patterns associated with the stressed syllable of words in narrow focus are the result of a focal pitch accent which is distinct from the pitch accent present in broad focus cases, another potential explanation must be considered. De la Mota (1997) and Face (2000) have shown that one of the phonetic manifestations of narrow focus in Spanish is the lengthening of the stressed syllable. It could be argued, therefore, that Spanish has only one pitch accent, and that the realization of the F0 peak within the stressed syllable in cases of narrow focus is merely the result of the syllable being longer than in broad focus cases.⁵ For this reason the duration of the stressed syllable and the duration of the F0 rise were compared in broad and narrow focus cases. The two limitations put on the data under consideration in 4.3.1 are again used here: First, in order to avoid the effects of tonal crowding on the duration of the rise, only cases with two or more intervening unstressed syllables are considered. Secondly, for narrow focus only those cases in which the F0 valley is realized within the stressed syllable are included in the calculation so as to prevent the cases where early peak alignment is not used as a marker of narrow focus from skewing the results for duration of the F0 rise since it has been shown that these cases instead employ F0 peak height for marking narrow focus.

4.5.1. Duration of the stressed syllable. Both de la Mota (1997) and Face (2000) show that narrow focus causes a significant lengthening of the stressed syllable. This is also the case in the present study, as can be seen in Table 8.

These results show a highly significant difference in the duration of the stressed syllable between words in broad and narrow focus, with the average duration of the stressed syllable in words in narrow focus being 65.5 ms longer than in broad focus. While this shows that duration could be the cause of early F0 peak alignment, this cannot be determined without also looking at the duration of the F0 rise in these same cases.

5. I am grateful to Keith Johnson for pointing out this possible alternative explanation.

Table 8. Duration of stressed first target stressed syllable by focus type

BROAD FOCUS n=72	134.1 ms SE = 3.9 ms
NARROW FOCUS n=18	199.6 ms SE = 7.7 ms
Probability (ANOVA)	p<.01

Table 9. Duration of the F0 rise by focus type

BROAD FOCUS n=96	218.5 ms SE = 4.6 ms
NARROW FOCUS n=24	161.4 ms SE = 9.3 ms
Probability (ANOVA)	p<.01

4.5.2. *Duration of the F0 rise.* If the realization of the F0 peak within the stressed syllable or words in narrow focused is to be explained by the extended duration of that syllable rather than by a focal pitch accent, then the prediction is that the characteristics of the F0 rise should be the same in narrow focus as in broad focus. Table 9 presents the results of average duration of the F0 rise by focus type.

The data in this table show that the F0 rise is different in narrow focus cases than in the broad focus cases. The F0 rise in narrow focus cases averages nearly 60 ms shorter than when in broad focus. So while it is true that the stressed syllable is longer in cases of narrow focus, it is also true that the F0 rise is shorter, providing further support for the analysis that there are two phonological pitch accents in Spanish.

5. Concluding discussion

Having shown that early F0 peak alignment is due to a separate pitch accent than late F0 peak alignment, I now move on to discuss some of the other arguments Hualde (2000) makes against an analysis containing two pitch accents. The first argument, based on Llisterri et al. (1995) and Prieto (p.c.), is that there is a strong tendency for F0 peaks to remain within word boundaries. Therefore Hualde (2000) claims that “in the case of phrase-medial oxytones, the peak is generally realized within the stressed syllable”. If the F0 peak is realized consistently within the stressed syllable of oxytone words, an unaligned H, as in L*+H, could be brought

into question. But, while this has been observed by Llisterri et al. (1995) and Prieto (p.c.), this pattern is not found in the Spanish of Madrid, which is the dialect under investigation in the present study. The data in Table 1 show that the F0 peak almost never occurs within the stressed syllable except in cases of extreme stress clash, and this is in spite of the fact that in the present study over half of the words containing the first target stressed syllables are oxytones. In the Spanish spoken in Madrid the F0 peak crosses word boundaries freely. Examples of this can be seen in Figure 1 b–c, where the F0 peak of the pitch accent associated with the stressed syllable of the first content word is clearly realized on the following word.

Another argument which Hualde (2000) makes against an analysis containing two pitch accents is again based on the L*+H pitch accent proposed by Face (in press) and Sosa (1999). Hualde (2000) claims that this use of the label L*+H is “at variance with the definition of this contour assumed by other scholars”. If there is no L*+H then it clearly cannot contrast with L+H* or (L+H)*. Hualde (2000) cites Ladd (1996:83) who states that “L*+H is an accent contour that is low for a good portion of the accented syllable and then rises sharply, often into the following unstressed syllable if there is one”. This statement by Ladd (1996), however, is used in describing Pierrehumbert’s (1980) taxonomy of pitch accents for American English. The proposed L*+H for Spanish is similar to that described by Ladd (1996) in that it has a low portion which is aligned with the stressed syllable and a high portion which can trail into the following unstressed syllable. The observation that the exact phonetic instantiation of L*+H in Spanish differs from the phonetic instantiation of the same phonological pitch accent in English is not a concern. In fact this type of phonetic difference is commonplace and is accepted by scholars in other cases (e.g., the phonetic differences between aspirated stops in English and Korean).

Another claim that Hualde (2000) makes is that an analysis of early F0 peaks based on intermediate phrase boundaries rather than on another pitch accent is able to account for the observed differences in F0 peak alignment without postulating a phonological contrast between two different pitch accents. There are two problems with this. First of all, why would one not want a contrast between two different pitch accents? There seems to be no theoretical reason to desire such a situation, and many languages have contrasting pitch accents. English, for example, has multiple contrasting pitch accents (Beckman and Pierrehumbert 1986, Pierrehumbert 1980, Pierrehumbert and Hirschberg 1990).

Another problem with this argumentation is that in seeking to avoid postulating a second pitch accent, it proposes an entire level of phrasing that finds almost no converging support in Spanish. There has been no conclusive evidence for the existence of intermediate phrases in Spanish, and several linguists have followed Sosa (1991, 1999) in claiming that they do not exist. While I do not wish to make the claim that intermediate phrases do not exist at all in Spanish, many of the factors which support their existence in languages such as English have not been found for Spanish. For example, if intermediate phrases exist, then intonational

phrases end in a sequence T-T %. This would predict that L-H % or H-L % could be found at intonational phrase boundaries, yet only simple rises and simple falls have been observed. In addition, both Hualde (2000) and Nibert (1999, 2000) show that sentence internal boundaries exist, but neither has shown that they have any characteristics which make them different from intonational phrase boundaries, raising the possibility that Spanish has only one level of prosodic phrasing. There seems to be no theoretical advantage to desiring an intermediate level of phrasing in Spanish as there is already evidence that different languages have different types of phrasing (e.g., see Beckman and Pierrehumbert 1986 and Pierrehumbert and Beckman 1988 for a comparison of English and Japanese).

6. Conclusions

The data presented above make two contributions to the study of Spanish intonation. First, they show the ways in which intonation is used to convey narrow focus in Spanish. While previous phonetic studies on focus have disagreed as to the ways in which narrow focus is conveyed prosodically (de la Mota 1997, Face 2000, Toledo 1989), none of the previous studies has systematically examined the role of intonation. Only de la Mota (1997) looks at F0 peak alignment at all, and even she does not note the interplay between F0 peak alignment and F0 peak height that has been shown in the present study.

The second contribution which the data in the present study make to the study of Spanish intonation is that they show that early F0 peak alignment in words in narrow focus is the result of a different pitch accent than that which causes late F0 peak alignment. The F0 valley following the pitch accent of the narrowly focused word was shown to align with the beginning of the next stressed syllable. This signifies that this F0 valley is the result of the L of the following pitch accent, since F0 valleys in Spanish are aligned with the beginning of stressed syllables. This alignment provided strong evidence against the claim made by Hualde (2000) and Nibert (2000) that the early F0 peak in narrowly focused words was caused by an immediately following L-. If an intermediate phrase boundary were present, the F0 valley would be realized at the right edge of the intermediate phrase (i.e., at the end of the narrowly focused word in the case under consideration). Since this is clearly not the case, and the F0 valley is the realization of the L of the following pitch accent, the postulation of any tonal event (e.g., an intermediate phrase boundary) between the end of the focal pitch accent and the following pitch accent cannot be maintained.

The two phonologically different pitch accents which were proposed by Face (in press) are L*+H for late F0 peak alignment and L+H* for early F0 peak alignment. I have argued above that L+H* is an adequate representation of the early F0 peak alignment in that the difference between the two pitch accents is the alignment of the F0 peak. Since the H is starred in one pitch accent and not in the other, this

contrast is reflected. However, I have also shown that even in the proposed L+H* pitch accent, the F0 valley is aligned with the stressed syllable nearly as strongly as in the L*+H pitch accent. Thus a more accurate representation is (L+H)*, indicating association of both tones to the stressed syllable. It is worth noting that this parenthetical notation is not standard within the AM model as it is commonly accepted that only one tone is associated with the stressed syllable. Despite this, the alignment data for the Spanish focal pitch accent motivate such a representation. What will be of interest for future study is to determine what causes the association of both tones to the stressed syllable in the case of the Spanish focal pitch accent.

Another area related to the present study which merits further investigation is the issue of whether or not Spanish has intermediate phrases. While the present study has shown that early F0 peaks in narrowly focused words are not caused by a following intermediate phrase boundary, this certainly does not mean that intermediate phrases might not exist in other cases in Spanish. As this is a major issue to be dealt with before a complete analysis of Spanish intonation is possible, a study comparing and contrasting utterance-internal and utterance-final boundaries is necessary in order to determine whether they are the same type of boundary or not. Only as experiments are carefully designed to tackle issues such as those mentioned here can a better understanding of the Spanish intonational system be achieved and a more complete phonological analysis of that system be proposed.

The analysis proposed here of the Spanish focal pitch accent takes a step in the direction of providing a more complete phonological analysis of the Spanish intonational system. It has considered two competing analyses of early F0 peak alignment in cases of words in narrow focus and has shown that only the analysis that there is a focal pitch accent can be upheld. In addition it has addressed the issue of different intonational markers of narrow focus in different positions within the sentence and has offered an explanation for their distribution.

Appendix

Corpus of dialogues recorded for the experiment described in section 3

1. A: ¿Qué dijo Mario?
B: Que le da números pertinentes.
A: ¿Que le pide números pertinentes?
B: No. Que le da números pertinentes.
2. A: ¿Qué dijo Mario?
B: Que le da números pertinentes.
A: ¿Que le da documentos pertinentes?
B: No. Que le da números pertinentes.
3. A: ¿Qué dijo Mario?
B: Que le daba números pertinentes.
A: ¿Que le pedía números pertinentes?

- B: *No. Que le daba números pertinentes.*
4. A: *¿Qué dijo Mario?*
 B: *Que le daba números pertinentes.*
 A: *¿Que le daba documentos pertinentes?*
 B: *No. Que le daba números pertinentes.*
5. A: *¿Qué dijo Mario?*
 B: *Que le daban el número pertinente.*
 A: *¿Que le pedían el número pertinente?*
 B: *No. Que le daban el número pertinente.*
6. A: *¿Qué dijo Mario?*
 B: *Que le daban el número pertinente.*
 A: *¿Que le daban el documento pertinente?*
 B: *No. Que le daban el número pertinente.*
7. A: *¿Qué dijo Mario?*
 B: *Que le dábamos el número pertinente.*
 A: *¿Que le pedíamos el número pertinente?*
 B: *No. Que le dábamos el número pertinente.*
8. A: *¿Qué dijo Mario?*
 B: *Que le dábamos el número pertinente.*
 A: *¿Que le dábamos el documento pertinente?*
 B: *No. Que le dábamos el número pertinente.*
9. A: *¿Qué dijo Mario?*
 B: *Que se lo daba para el número pertinente.*
 A: *¿Que se lo pedía para el número pertinente?*
 B: *No. Que se lo daba para el número pertinente.*
10. A: *¿Qué dijo Mario?*
 B: *Que se lo daba para el número pertinente.*
 A: *¿Que se lo daba para el documento pertinente?*
 B: *No. Que se lo daba para el número pertinente.*
11. A: *¿Qué dijo Mario?*
 B: *Que se lo dábamos para el número pertinente.*
 A: *¿Que se lo pedíamos para el número pertinente?*
 B: *No. Que se lo dábamos para el número pertinente.*
12. A: *¿Qué dijo Mario?*
 B: *Que se lo dábamos para el número pertinente.*
 A: *¿Que se lo dábamos para el documento pertinente?*
 B: *No. Que se lo dábamos para el número pertinente.*
13. A: *¿Qué dijo Mario?*
 B: *Que lo terminó Nana ayer.*
 A: *¿Que lo comenzó Nana ayer?*

- B: *No. Que lo terminó Nana ayer.*
14. A: *¿Qué dijo Mario?*
 B: *Que lo terminó Nana ayer.*
 A: *¿Que lo terminó Pablo ayer?*
 B: *No. Que lo terminó Nana ayer.*
15. A: *¿Qué dijo Mario?*
 B: *Que lo terminó la nana de los niños.*
 A: *¿Que lo comenzó la nana de los niños?*
 B: *No. Que lo terminó la nana de los niños.*
16. A: *¿Qué dijo Mario?*
 B: *Que lo terminó la nana de los niños?*
 A: *¿Que lo terminó la abuela de los niños?*
 B: *No. Que lo terminó la nana de los niños.*
17. A: *¿Que dijo Mario?*
 B: *Que terminó la banana de la chica.*
 A: *¿Que vio la banana de la chica?*
 B: *No. Que terminó la banana de la chica.*
18. A: *¿Qué dijo Mario?*
 B: *Que terminó la banana de la chica.*
 A: *¿Que terminó la manzana de la chica?*
 B: *No. Que terminó la banana de la chica.*
19. A: *¿Qué dijo Mario?*
 B: *Que terminó con la banana de la chica.*
 A: *¿Que durmió con la banana de la chica?*
 B: *No. Que terminó con la banana de la chica.*
20. A: *¿Qué dijo Mario?*
 B: *Que terminó con la banana de la chica.*
 A: *¿Que terminó con la manzana de la chica?*
 B: *No. Que terminó con la banana de la chica.*
21. A: *¿Qué dijo Mario?*
 B: *Que terminó lo de la banana de la chica.*
 A: *¿Que comenzó lo de la banana de la chica?*
 B: *No. Que terminó lo de la banana de la chica.*
22. A: *¿Qué dijo Mario?*
 B: *Que terminó lo de la banana de la chica.*
 A: *¿Que terminó lo de la manzana de la chica?*
 B: *No. Que terminó lo de la banana de la chica.*
23. A: *¿Qué dijo Mario?*
 B: *Que terminó con lo de la banana de la chica.*
 A: *¿Que comenzó con lo de la banana de la chica?*

- B: *No. Que terminó con lo de la banana de la chica.*
24. A: *¿Qué dijo Mario?*
 B: *Que terminó con lo de la banana de la chica.*
 A: *¿Que terminó con lo de la manzana de la chica?*
 B: *No. Que terminó con lo de la banana de la chica.*

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References

- Alcoba, Santiago and Julio Murillo (1998). Intonation in Spanish. In *Intonation Systems: A Survey of Twenty Languages*, Daniel Hirst and Albert Di Cristo (eds.), 152–166. Cambridge: Cambridge University Press.
- Beckman, Mary E. and Gayle M. Ayers (1994). Guidelines for ToBI labelling, version 2.0. Ms. and accompanying speech materials, The Ohio State University.
- Beckman, Mary E. and Janet B. Pierrehumbert (1986). Intonational structure in Japanese and English. *Phonology Yearbook* 3:255–309.
- de la Mota, Carme (1997). Prosody of sentences with contrastive new information in Spanish. *ESCA Workshop on Intonation: Theory, Models and Applications*, 75–78. ESCA.
- Face, Timothy L. (in press). A phonological analysis of rising pitch in Castilian Spanish. *Hispanic Linguistics* 11.
- (2000). Prosodic manifestations of focus in Spanish. *Southwest Journal of Linguistics* 19: 45–62.
- Fant, Lars (1984). *Estructura informativa en español. Estudio sintáctico y entonativo*. Acta Universitatis Upsaliensis, 34. Uppsala.
- Frota, Sónia (1998). Prosody and focus in European Portuguese. Doctoral dissertation, Universidade de Lisboa.
- Garrido, Juan M.; Joaquim Llisterri; Carme de la Mota and Antonio Ríos (1993). Prosodic differences in reading style: Isolated vs. contextualized sentences. *EUROSPEECH '93*: 573–576.
- Garrido, Juan M.; Joaquim Llisterri; Carme de la Mota; Rafael Marín and Antonio Ríos (1995). Prosodic markers at syntactic boundaries in Spanish. *ICPhS* 13: 370–373.
- Hualde, José Ignacio (2000). Intonation in Spanish and the other Ibero-Romance languages: Overview and status quaestionis. Paper presented at the 30th Linguistic Symposium on Romance Languages, University of Florida, 24–27 February.
- Ladd, D. Robert (1996). *Intonational Phonology*. Cambridge: Cambridge University Press.
- Llisterri, Joaquim; Rafael Marín; Carme de la Mota and Antonio Ríos (1995). Factors affecting F0 peak displacement in Spanish. *EUROSPEECH '95*: 2061–2064.
- Navarro Tomás, Tomás (1944). *Manual de entonación española*. New York: Hispanic Institute in the United States.
- Nibert, Holly J. (1999). A perception study of intermediate phrasing in Spanish intonation. In *Advances in Hispanic Linguistics*, Javier Gutiérrez-Rexach and Fernando Martínez-Gil (eds.), 231–247. Somerville: Cascadilla Press.
- (2000). Phonetic and phonological evidence for intermediate phrasing in Spanish intonation. Doctoral dissertation, University of Illinois at Urbana-Champaign.
- Pierrehumbert, Janet B. (1980). The phonology and phonetics of English intonation. Doctoral dissertation, MIT.
- Pierrehumbert, Janet and Mary E. Beckman (1988). *Japanese tone structure*. Cambridge, MA: MIT Press.

- Pierrehumbert, Janet and Julia Hirschbert (1990). The meaning of intonational contours in the interpretation of discourse. In *Intentions in Communication*, Philip Cohen, Jerry Morgan and Martha Pollack (eds.), 271–311. Cambridge, MA: MIT Press.
- Prieto, Pilar (1998). The scaling of the L values in Spanish downstepping contours. *Journal of Phonetics* 26: 261–282.
- Prieto, Pilar, Holly Nibert and Chilin Shih (1995). The absence or presence of a declination effect on the descent of F0 peaks? Evidence from Mexican Spanish. In *Grammatical Theory and Romance Languages*, Karen Zagona (ed.), 197–207. Philadelphia: John Benjamins.
- Prieto, Pilar and Chilin Shih (1995). Effects of tonal clash on downstepped H* accents in Spanish. *EUROSPEECH '95*: 1307–1310.
- Prieto, Pilar, Chilin Shih and Holly Nibert (1996). Pitch downtrend in Spanish. *Journal of Phonetics* 24: 445–473.
- Prieto, Pilar; Jan van Santen and Julia Hirschberg (1995). Tonal alignment patterns in Spanish. *Journal of Phonetics* 23: 429–451.
- Sosa, Juan Manuel (1991). Fonética y fonología de la entonación del español hispanoamericano. Doctoral dissertation, University of Massachusetts.
- Sosa, Juan Manuel (1999). *La entonación del español*. Madrid: Cátedra.
- Toledo, Guillermo Andrés (1989). Señales prosódicas del foco. *Revista Argentina de Lingüística* 5: 205–230.
- Willis, Erik (2000). Acoustic evidence for the Spanish imperative intonation: Pitch-accent range and alignment. Paper presented at the 30th Linguistic Symposium on Romance Languages, University of Florida, 24–27 February.