

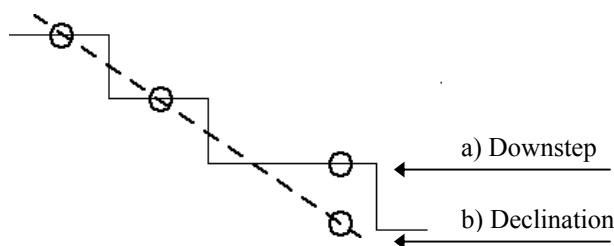
# The Direction of Inflection: Downtrends and Uptrends in Peruvian Spanish Broad Focus Declaratives

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## 1. Introduction

In a cross-dialect analysis of Spanish language varieties, the intonation features of *downstep* and *declination* ought to be considered as two important points of comparison. For a given utterance, a number of peaks may be observed that are associated with stressed syllables. The first peak may be relatively high, near the top of the speaker's range, while the following peaks tend to each be lower than the previous one. The term *downstep* is used to describe the successive lowering of pitch at specific tonal events according to position within a pitch contour; *declination* is considered a time-dependent phenomenon in which pitch is lower according to the progression of the phrase along the time-axis (Lieberman and Pierrehumbert 1984) (see Figure 1). Downstep may operate over the whole utterance, or over a portion of the utterance. However, the domain of declination is considered to be over the entire utterance.



**Figure 1.** Representation of successively lower peaks (shown as circles): In a), the third peak is shown at the level of the third step down, i.e., downstepped; in b), the third peak is shown as occurring lower, since it occurs later in the utterance, i.e., as the result of overall declination.

Therefore, downstep may occur only for non-final prenuclear accents, or may also include the final nuclear pitch accent, as described by Cruttenden (1997:122). Conversely, a tonal event that occurs higher than preceding events is considered to be 'upstepped.' Truckenbrodt (2002) describes *upstep* as a return to the initial pitch height, which may then be followed by partial reset of pitch level from which point a new series of downstep begins. The upstepped peak in these cases may reach but not exceed the register level established by the initial peak at the beginning of the utterance. This paper examines the relationship between peak heights as seen in Peruvian Spanish in order to determine how the features of downstep, upstep, and declination operate in comparison to other varieties of Spanish.

Ladd (1996) discusses differences in downstep between English and other European languages in declarative utterances. For English, downstep may indicate more finality of a phrase, but does not add any other additional meaning, such that downstep and focus do not seem to be strongly related (Ladd 1996:126-127). Ladd compares this observation of English with findings on European Portuguese, which show a downstepped nuclear pitch accent to be neutral while a non-lowered accent may indicate narrow focus on that constituent (e.g., as described in Frota (1998)). Finally, Ladd notes that reading styles for declaratives in Romance languages have been shown to employ downstep of final accents. Likewise, D'Imperio (2003) describes broad focus statements in standard Italian as being 'inherently downstepped,' whereas narrow focus statements contain a more 'salient rise.'

For English, Pierrehumbert (1980) found that the majority of overall downtrend could be explained by downstep (Ladd 1996:74). Likewise, for Mexican Spanish, Prieto et al. (1996) found that lower subsequent peaks could be adequately explained and modeled by incorporating a downstep feature in predicting following peak heights. Other factors such as time between peaks and length of the utterance were also considered; however, these factors were not shown to contribute significantly to the general lowering process. Final nuclear peaks were observed to be lower than predicted by downstep itself, such that an additional process of *final lowering* was identified for Spanish, similar to that found by Liberman and Pierrehumbert (1984) for English. In his overview of Spanish intonation, Sosa (1999) presents several examples of downstep in declaratives produced by speakers of different varieties of Peninsular and Latin American Spanish. Face (2001) also found downstep to be present in broad focus declaratives in Madrid Spanish. The greatest amount of downstep was observed between the first and second peaks. The nuclear pitch accent was described as being affected by final lowering, causing the drop in pitch to be greater than that observed earlier in the utterance (Face 2001:58-59). Also, fewer instances of a final rise were observed (60%), compared to peaks in the penultimate position (86%). In his analysis of Dominican Spanish as spoken in Santiago de los Caballeros, Willis (2003:108) also observed a drop in tonal target level from prenuclear to nuclear position in broad focus declaratives for both peaks and valleys. These findings suggest that, although lower subsequent peaks are found in general for Spanish, there may be specific dialect-related differences: for example, downstep in Mexican Spanish (Prieto et al. 1996) was shown to occur throughout the contour, whereas in Madrid Spanish (Face 2001), downstep was greatest between the first two peaks, although both varieties demonstrate final lowering.

Aside from the clear realization of tonal targets, there may also be peaks that are either greatly attenuated or apparently absent altogether. A stressed syllable may be considered to be 'deaccented', especially when the word has been recently mentioned (Ladd 1996:175). However, this deaccenting is more characteristic of English and German than Spanish and French, according to Cruttenden (1997:144). As discussed in Hualde (2003), Romance languages may also differ in the number of pitch accents present. For example, research on European Portuguese (Frota 1998, 2002) finds fewer pitch accents in Portuguese (an initial and final pitch accent with an intervening plateau) than other Romance languages. Another option is to describe an apparently deaccented stressed syllable as L\*, as appears in Sosa (1999). However, this notation would not necessarily apply to languages, such as the case of European Portuguese previously mentioned, which demonstrate a high continuous plateau between two peaks. Also, Hualde (2003) offers that there may be cases in Spanish of accent reduction of varying degrees, even when there is not narrow focus on another constituent within the utterance. Willis (2003) observed an occasional absence of tonal movement in lexically stressed words in prenuclear position in both read and spontaneous speech produced by Dominican Spanish speakers. Since many observations on deaccenting in Spanish are based on laboratory speech, Willis notes that more research is needed to gain a broader view of this phenomenon (see also Face (2003:121-122) for discussion on deaccenting).

In the above discussion, I have concentrated on observations and research based on broad focus declaratives. However, downstep, upstep, and declination may behave differently in other modalities (e.g., in interrogatives) and in other pragmatic contexts (e.g., narrow contrastive focus), as well as with different types of phrasing (Beckman et al. 2002, Face 2001<sup>1</sup>, Hualde 2003, Nibert 2000, Willis 2003,

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<sup>1</sup> See also Face (2002) for a published version by Lincoln of Face (2001).

among others). Since the data presented in this paper will only address broad focus declaratives, I will leave the discussion of these phenomena in other contexts for a later time. The current study has three main goals: first to provide a characterization of the heights of peaks within broad focus declaratives as produced by Peruvian Spanish speakers (e.g., the presence or absence of downstep), second to examine some of the linguistic variables that may affect the realization of peak heights (e.g., height of previous peak or time between peaks), and third to address the possibility of sociolinguistic variables that may also affect the instantiation of these features (e.g., regional differences between Lima and Cuzco, and speaker differences, such as knowledge of and possible influence from Quechua). Below I first describe the data set to be analyzed and provide an overview of the findings. Next I present the height relationship between peaks in the utterance in terms of downstep and declination. Last I compare these findings across groups of Spanish speakers in Peru as well as with previous research on Spanish.

## 2. Experimental procedures

The participants, target utterances, and data collection procedure are described below. Recordings were made in Lima and Cuzco, Peru, as representative of two distinct regional varieties of Spanish found in Peru, *ribereño* Spanish and Andean Spanish (Escobar 1978). A series of utterances were recorded as produced by twenty male Spanish speakers, ages 18-39, who reported having received or completed post-secondary education. The Lima group consisted of five monolingual Spanish speakers, while the Cuzco group is subdivided between seven participants who, before starting primary school, spoke only Spanish (native Spanish speakers), five participants who spoke both Quechua and Spanish (native Quechua/Spanish bilinguals), and three participants who spoke only Quechua before entering the school system (native Quechua speakers, i.e., second language learners of Spanish).<sup>2</sup> The target utterances were broad focus declaratives, which were written on index cards preceded by a prompting question intended to elicit a neutral context (e.g., *¿Qué pasa?* ‘What is happening?’; *El niño añade los rábanos.* ‘The child is adding the radishes’.) These declaratives, which were part of a larger set of utterances that included other types of pragmatic focus, such as narrow or contrastive focus, were read in a pseudo-randomized order. A total of 480 broad focus declaratives were analyzed (12 utterances x 2 productions x 20 speakers); (see Appendix Table A1 for a listing of target utterances). The target utterances all maintained an SVO word order and contained three stressed syllables. The recordings were made with a *Shure* 512 head-mounted microphone, a *Sharp* MD-SR60 minidisc recorder and *Sony* blank minidisks, and then transferred to the computer at a sampling rate of 44.1 Hz (16 bit). Analysis of the recordings was performed with the program *Praat* (Boersma and Weenink 1992-2004) using the autocorrelation method to extract the fundamental frequency (F0) contour. Syllable and word boundaries were determined by examining the F0 pitch track along with the waveform, spectrogram, and intensity, as well as by listening. Measurements of the peak height were taken (in Hz) as the highest F0 inflection point associated with a stressed syllable (either during or afterward). The three peaks are labeled H1, H2, and H3 respectively. The initial and final F0 height is labeled IT and FT. The F0 minima immediately preceding each peak are labeled L1, L2, and L3, while the last minimum before the final F0 height is labeled L4.<sup>3</sup> A measurement was not taken if the difference between peak and valley was less than 7 Hz<sup>4</sup>, if there was a pause or if there was a break in the intonation contour.

<sup>2</sup> The recordings in Lima were conducted at the Pontificia Universidad Católica del Perú (PUCP), while the recordings in Cuzco were made at the Centro Bartolomé de las Casas (CBC). Lima speakers are labeled L01-L05; Cuzco native Spanish speakers are labeled C01-C07; Cuzco native Quechua/Spanish bilinguals are labeled C21-C25; and Cuzco native Quechua speakers are labeled C31-C33.

<sup>3</sup> This notation procedure is modeled from that employed by Prieto et al. (1996:44) and Willis (2003:131-132) for the analysis of Spanish intonation.

<sup>4</sup> The threshold of 7 Hz has been employed as an operational definition of a peak, in order to provide a point of comparison between previous research on intonation. Klatt (1973:11) showed a just noticeable difference (JND) in synthesized speech of 2.0 Hz when the F0 contour is a ‘linear descending ramp’. In her analysis of declination, Pierrehumbert (1979) showed listeners to demonstrate a greater degree of adjustment to wide-range stimuli (71 Hz) than narrow-range stimuli (41 Hz). The cross-over point at which speakers determined the second peak to be lower than the first was 9.2 Hz for the wide-range stimuli and 5.6 Hz for the narrow range stimuli. For the current

This data set represents only those peaks that were measurable given the above criteria. Some stressed syllables did not have a notable pitch movement. However, since the data collection procedures concentrate on the presence of peaks, it should be noted these peaks are not included in the current data set. A separate, brief discussion of these ‘less-apparent’ peaks is included to illustrate this peak reduction phenomenon as seen in these broad focus declaratives.

### 3. Peak heights in Peruvian Spanish

#### 3.1. Overview of findings

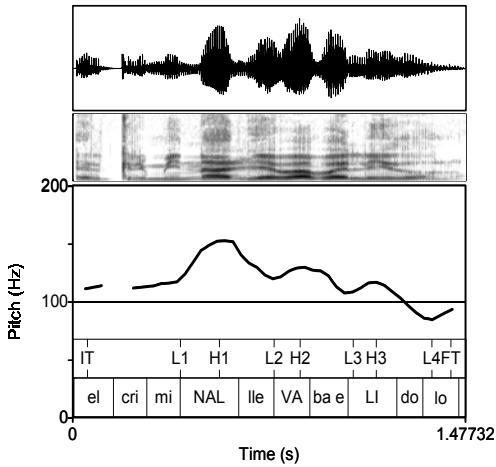
In this section, I present examples of downstepped, upstepped and level peaks. The relative distribution of these patterns per speaker is discussed in the next section. First, there are instances of downstep through final, nuclear position, as in Figure 2. There are also cases in which the second peak and final peak appear at the same level, as in Figure 3 and Figure 4. Then there are examples of a higher nuclear peak, which may be considered to be upstepped, as in Figure 5. For each figure, the stressed syllables appear in capital letters, and are underlined in the figure caption.

As previously stated, there are also examples in this corpus of ‘less-apparent’ tonal events. Figure 6 shows an example of this reduced tonal event in final nuclear position, and Figure 7 shows this realization in second, prenuclear position.<sup>5</sup> A placeholder (T) is included in the annotation to indicate where this tonal event is expected to otherwise occur. Although the peaks that show a rise of less than 7 Hz still represent tonal patterns within these Spanish varieties, these instances are fewer than those with a clear realization of peaks and valleys. The percentage of measurements that did not meet the previous criteria is relatively low: In the subject position, all cases showed a rise. For the Lima group, 22% of the stressed syllables in verb position lacked an appreciable rise and 19% in object position; the Cuzco group showed 11% of potential peaks without an appreciable rise in verb position and 13% in object position. Therefore, the findings here on the downstep of peaks are presented with the understanding that other, less frequent patterns may also be present. In other varieties of Spanish, this type of less-apparent nuclear peak may be considered to be more common (see Prieto et al. (1996:449-450) for discussion). In the analysis of other languages, such as German, this much lower peak is described as being the result of “total downstep” to near the bottom of the speaker’s range, as opposed to “partial downstep”, in which the peak is still above this level, as found in English and German (Grabe 1998).

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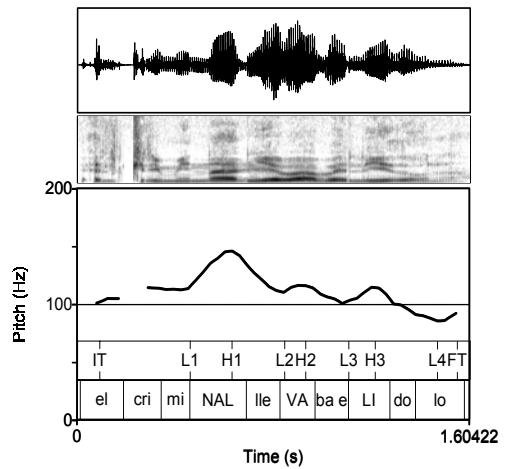
experiment, the working definition of peaks being more than 7 Hz greater than the surrounding tonal environment is set above the JND described in Klatt (1973) and the declination cross-over point for narrow range stimuli in Pierrehumbert (1979). (Note: Averaging the cross-over points for the two ranges gives 7.4 Hz or ~7 Hz.)

<sup>5</sup> In Figure 6 and Figure 7, these examples have been labeled as “locally less-apparent peaks” in comparison to the surrounding F0 contour. This descriptive label has been used instead of the term “deaccented peaks” which, as noted by an anonymous reviewer, may imply a lack of perceptual emphasis placed on the stressed syllable. Even for those “locally less-apparent peaks”, the lexically stressed syllable itself may still be perceived as accented and still maintain a degree of prominence within the utterance.



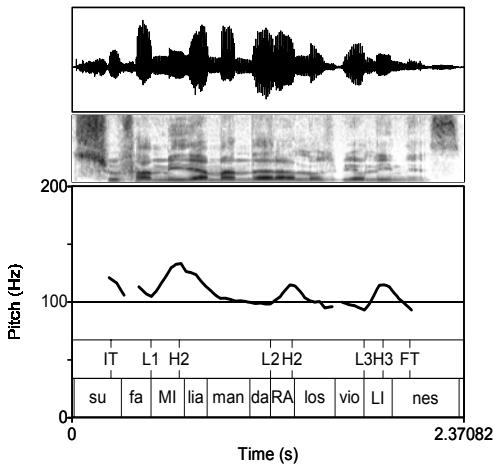
*El criminal llevaba el ídolo*  
 ‘The criminal carried the idol.’

**Figure 2.** Downstep of all three peaks  
 Cuzco Quechua-Spanish bilingual, speaker C21



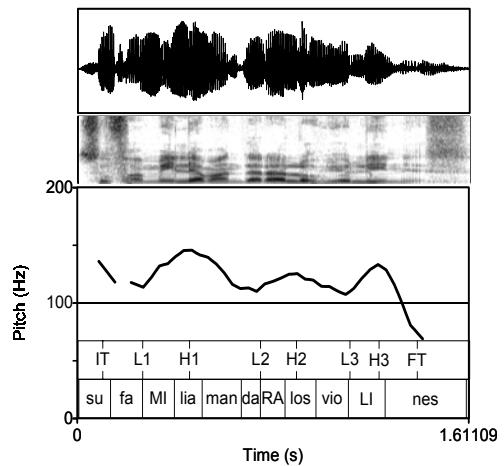
*El criminal llevaba el ídolo*  
 ‘The criminal carried the idol.’

**Figure 3.** Downstep between non-final peaks  
 Cuzco Quechua-Spanish bilingual, speaker C21



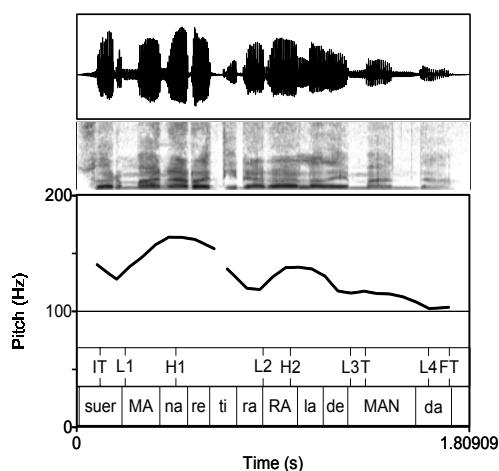
*Su familia mandará los violines*  
 ‘His family will send the violins.’

**Figure 4.** Downstep of non-final peaks  
 Cuzco Quechua-Spanish bilingual, speaker C22



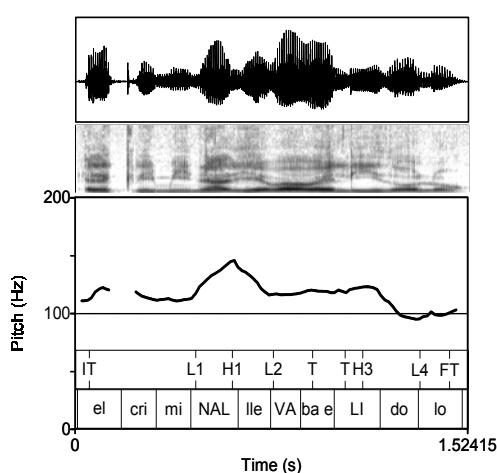
*Su familia mandará los violines*  
 ‘His family will send the violins.’

**Figure 5.** Upstep of final nuclear peak  
 Lima native Spanish speaker, speaker L04



*Su hermana retirará la demanda*  
 ‘Her sister will withdraw the complaint.’

**Figure 6.** Locally less-apparent nuclear peak (T).  
 Lima native Spanish speaker, speaker L04

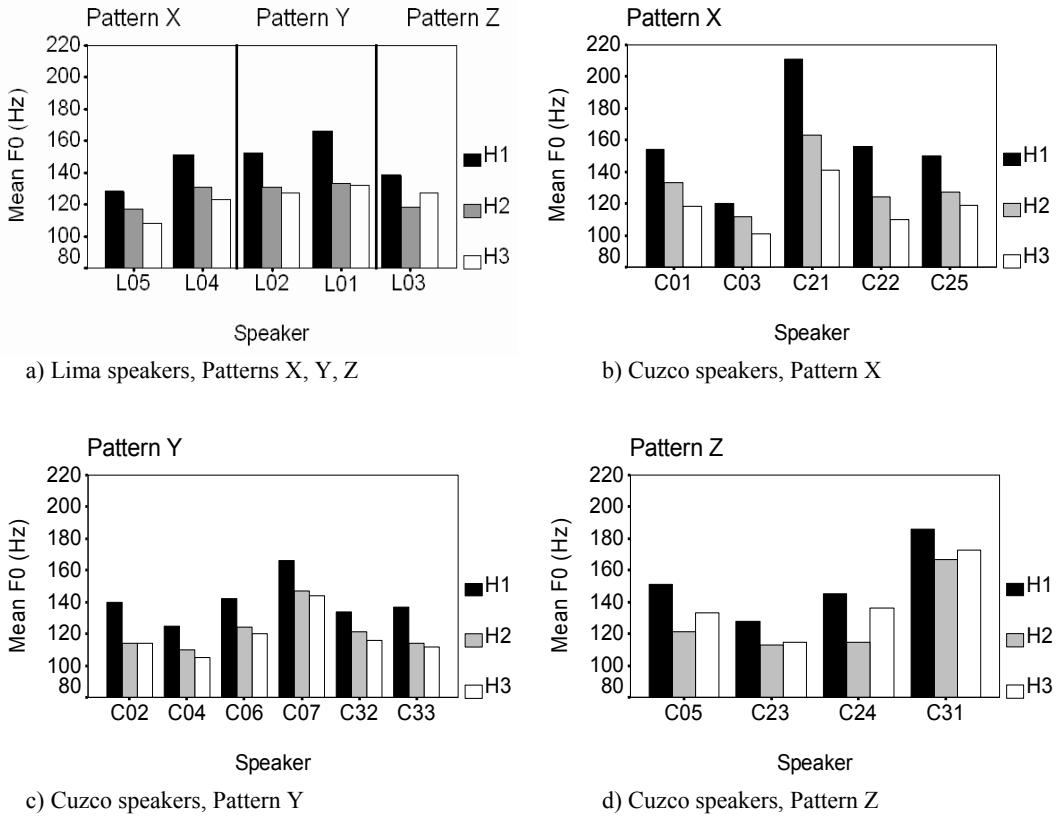


*El criminal llevaba el ídolo.*  
 ‘The criminal carried the idol’.

**Figure 7.** Locally less-apparent prenuclear peak (T).  
 Lima native Spanish speaker, speaker L04

### 3.2 Comparison of peak heights

Concentrating just on peak pitch levels, the results from individual speakers are compared. Three patterns of pitch levels have been identified, based on average peak heights for each speaker. The first configuration, assigned the label Pattern X, demonstrates downstep through all three peaks ( $H1 > H2 > H3$ ), with the second and third peaks lower than the previous peak. In Pattern Y, H1 is higher than the remaining two peaks, which are realized at nearly the same level ( $H1 > H2 \cong H3$ ) (i.e., there is downstep between the first two peaks, but not between the prenuclear and nuclear peaks). For Pattern Z, the average height of H3 is higher than that of H2, which is still lower than H1 ( $H1 > H3 > H2$ ) (i.e., the second prenuclear peak is downstepped, but the final nuclear peak is upstepped). In this last pattern, the upstepped peak does not actually exceed the height of the initial peak in this data set. Within the Lima group, all three patterns are present (see Figure 8a). Likewise, in the Cuzco group, these three patterns are present. A direct correspondence between native language/s of Cuzco speakers and the pattern of peaks is not demonstrated. Rather, native Spanish speakers (C01-C07) show patterns X, Y and Z, native Quechua-Spanish bilinguals (C21-C25) show patterns X and Y while the native Quechua speakers (C31-C33) demonstrate the last two patterns Y and Z in Spanish (see Figure 8b, 8c, and 8d). In this sense, there seems to be a progression towards non-downstepped final peaks, moving from Cuzco speakers who are monolinguals in Spanish to native bilinguals to native Quechua speakers. What each pattern has in common is that the second prenuclear peak (H2) is consistently lower than the first prenuclear peak (H1) for all speakers. These patterns differ in how the nuclear pitch accent (H3) is treated.

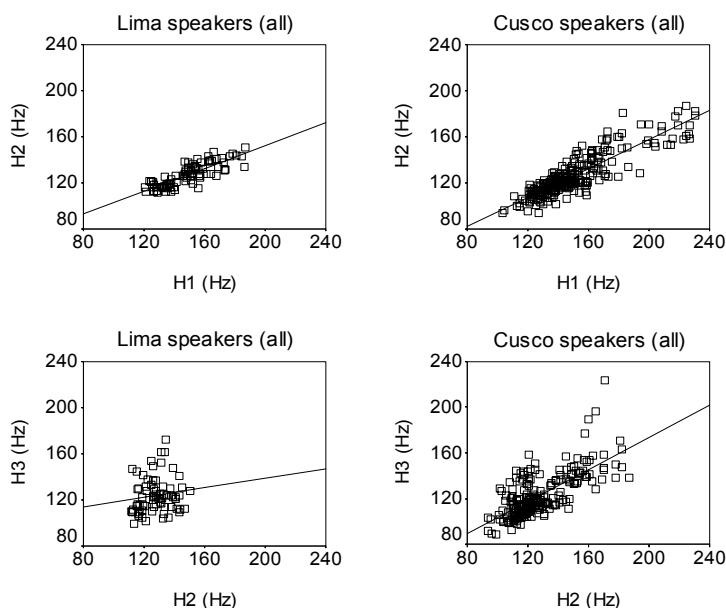


**Figure 8.** Mean F0 peak height (in Hz) according to pattern of peaks H1-H2-H3: a) shows all three patterns for Lima speakers; b) shows Pattern X, with downstep throughout for Cuzco speakers; c) shows Pattern Y, with relatively equal second and third peaks for Cuzco speakers; d) shows Pattern Z, with upstepped third, nuclear peak.

To analyze the data, a series of linear regressions was conducted. The correlation coefficient ( $R$ ) indicates the fit of the linear regression line to the data, whereas  $R$  squared ( $R^2$ ) represents the portion of the total variance within the data that is explained by (or can be predicted from) the straight line. For example if  $R^2 = 0.755$ , then 75.5% of the variance in the data can be accounted for with the regression line (i.e., the assumed linear relationship between the dependent and independent variables). The slope of the regression line demonstrates the amount of scaling of subsequent tonal targets. Therefore, if the slope is 0.60 for H2 vs. H1, then the second peak is 0.6 times the height of the first peak, or 40% lower than the first peak, (i.e., the second peak is downstepped).

For both the Lima and Cuzco groups, the linear correlation between adjacent peak heights is shown in Figure 9 and Table 1.<sup>6</sup> (Individual correlations for each speaker are not conducted due to low numbers of data points for some speakers). The correlation coefficient is high for Lima (H2 vs. H1) and Cuzco (H2 vs. H1 and H3 vs. H2),  $R=0.817$ ,  $0.880$ , and  $0.790$  respectively. However, the correlation is low for the second to third peak for Lima speakers (H3 vs. H2),  $R=0.132$ .

<sup>6</sup> It is important to note, as will be further discussed in Section 4, that these graphs represent an overall composite view of the data. In the target utterances, there are three lexical stress patterns and four possible intervening syllables. The most common stress pattern is paroxytone; the most common number of intervening syllables is two. See Table A3 and Table A4 for a division of the number of tokens measured. However, what can be noted is that the percentages of tokens measured are similar for both Lima and Cuzco. Therefore, comparisons can be made of the two groups relative to one another. A subsequent study that balances for the different possible conditions may help to strengthen the initial claims made here for the groups considered, as well as at the individual speaker level.



**Figure 9.** Peak height vs. Previous peak height (in Hz) for Lima and Cuzco groups. The diagonal line is the best-fit linear regression line.

<b>LIMA (all)</b>	<b>R</b>	<b>R<sup>2</sup></b>	<b>N</b>	<b>P</b>	<b>CUZCO (all)</b>	<b>R</b>	<b>R<sup>2</sup></b>	<b>N</b>	<b>P</b>
H2 vs. H1 (Hz)	0.817	0.668	84	<0.0001	H2 vs. H1 (Hz)	0.880	0.775	244	<0.0001
H3 vs. H2 (Hz)	0.132	0.017	71	0.2737	H3 vs. H2 (Hz)	0.709	0.503	213	<0.0001

**Table 1.** Correlation coefficients R and R squared of peak height with previous peak height for Lima and Cuzco groups.

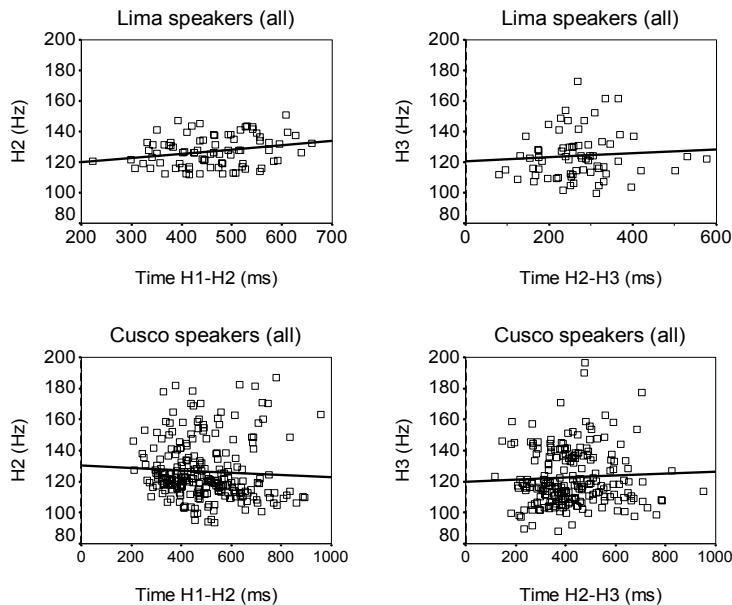
The Cuzco group was subdivided according to native language and according to peak pattern (determined by mean values and range of their utterances), as described previously. In general, the correlation coefficient (R) remained relatively high in all cases, although slight variations were observed. For the remaining calculations, the language grouping and pattern grouping will be employed, although other groupings may also allow a different view of the data.

In terms of downstep, the slope of the regression line for each correlation has been included in Table 2. If the correlation coefficient (R) is higher than 0.7, the slope value appears in bold, since the correlation coefficient indicates a good fit of the data. However, if  $R < 0.7$ , then the slope should not be considered to be a strong indication of downstep, since there is not a good fit with the data. As previously stated, the lower the slope value, the greater the degree of downstep. As seen in Table 2, downstep appears to be in effect for Lima and Cuzco prenuclear peaks: the Lima group shows the greatest amount of downstep, the Cuzco native Spanish speakers and native Quechua-Spanish bilinguals show slightly less downstep, and the native Quechua speakers show the least amount of downstep. In nuclear position, the Cuzco native Spanish group demonstrates the absence of downstep of the nuclear peak, whereas the Lima group shows some indication of downstep, although the correlation is low. The native Quechua-Spanish group shows a great degree of downstep of nuclear peaks (similar to Lima prenuclear peaks). Conversely, native Quechua speakers as a group actually demonstrate upstep of nuclear peaks, with a slope greater than 1, i.e., higher prenuclear H2 peaks result in even higher nuclear H3 peaks. The overall decrease in the amount of downstep is also seen with the peak height pattern groups, with the slope progressively increasing from Pattern X to Pattern Z.

Linear regression		H2 vs. H1		H3 vs. H2		Linear regression		H2 vs. H1		H3 vs. H2		
Group	Slope	R	Slope	R	Group	Slope	R	Slope	R	Group	Slope	R
LIMA (all)	<b>0.49</b>	0.871	0.21	0.132	LIMA (all)	<b>0.49</b>	0.871	0.21	0.132	LIMA (all)	<b>0.49</b>	0.871
CUZCO (all)	<b>0.63</b>	0.880	<b>0.71</b>	0.709	CUZCO (all)	<b>0.63</b>	0.880	<b>0.71</b>	0.709	CUZCO (all)	<b>0.63</b>	0.880
CUZCO (SP)	<b>0.62</b>	0.795	0.77	0.632	CUZCO (X)	<b>0.58</b>	0.896	<b>0.69</b>	0.844	CUZCO (X)	<b>0.58</b>	0.896
CUZCO (QU/SP)	<b>0.61</b>	0.917	<b>0.50</b>	0.698	CUZCO (Y)	<b>0.74</b>	0.842	<b>0.85</b>	0.885	CUZCO (Y)	<b>0.74</b>	0.842
CUZCO (QU)	<b>0.88</b>	0.938	<b>1.14</b>	0.883	CUZCO (Z)	<b>0.70</b>	0.861	<b>0.92</b>	0.776	CUZCO (Z)	<b>0.70</b>	0.861

**Table 2.** Slope of linear regression best-fit line for Lima and Cuzco groups and language and pattern subgroups. Slope values in bold correspond to  $R > 0.7$ . Lower slope values indicate greater downstep to subsequent tonal targets. (SP=native Spanish speakers, QU/SP=native Quechua/Spanish bilingual speakers, and QU=native Quechua speakers; X=Pattern X, Y=Pattern Y, Z=Pattern Z)

In addition to downstep, peak heights have been examined for time dependency in order to determine if declination is in effect as well. Comparing peak height to temporal distance between peaks shows only very minimal positive correlations for the Lima and Cuzco groups. See Figure 10 and Table 3 below. Within the Cuzco group, subdividing speakers according to native languages does not produce notably higher correlation coefficients. These analyses show that peak levels are realized independent of the time interval from the previous peak, i.e., longer intervals do not necessarily correspond to lower peaks. In this sense, declination does not appear to operate in determining peak height. These findings are similar to those reported in Prieto et al. (1996) for Mexican Spanish, which showed a negative correlation between the time between peaks and drop in pitch between them.



**Figure 10.** Peak height (F0 measured in Hz) vs. Time between peaks (ms) for Lima and Cuzco groups. Diagonal line is the best-fit linear regression line. Appearing to be nearly flat in all cases, this line demonstrates the low degree of correlation between the two variables considered.

<b>H2 (Hz) vs. Time H1-H2 (ms)</b>	<b>R</b>	<b>R<sup>2</sup></b>	<b>N</b>	<b>P</b>	<b>H3 (Hz) vs. Time H2-H3 (ms)</b>	<b>R</b>	<b>R<sup>2</sup></b>	<b>N</b>	<b>P</b>
LIMA (ALL)	0.240	0.058	83	0.0287	LIMA (ALL)	0.075	0.006	70	0.5363
CUZCO (ALL)	0.059	0.003	243	0.3604	CUZCO (ALL)	0.048	0.002	214	0.4854

**Table 3.** Correlation of peak height with time between peaks for Lima and Cuzco groups overall.

#### 4. Summary of findings on Peruvian Spanish downtrends and uptrends

As shown in the analysis above, peak heights in Lima and Cuzco Spanish demonstrated similarities between the two groups. Certain patterns of relationships between peaks were identified. Specifically, the second prenuclear peak was noted to be downstepped, i.e., the second peak was consistently lower than the first for all speakers. A higher, upstepped nuclear peak (labeled as Pattern Z) was observed within both the Lima and Cuzco groups: Mean peak heights in nuclear position were shown to be higher than the preceding peak for one Lima speaker, one native Spanish speaker from Cuzco, two native Quechua-Spanish bilinguals from Cuzco and one native Quechua speaker from Cuzco. However, no additional pragmatic meaning is expected for these examples, since all were elicited with the same broad focus prompting question. The remainder of the speakers either showed a lower nuclear peak (Pattern X) or a nuclear peak at nearly the same level as the preceding peak (Pattern Y). Given this distribution, final lowering of nuclear peaks does not appear to be categorical, and could only be postulated for those identified as demonstrating a ‘Pattern X’ type relationship between peaks with a lower nuclear peak. In spontaneous speech recordings of Central Peninsular Spanish, Face (2003) observes the presence of non-downstepped peaks, which he describes as possibly being due to the more specified pragmatic context found in spontaneous speech (compared to lab speech), in which speakers may incorporate other factors such as emotion, attitudes, emphasis, etc. In terms of the current study of read speech, the gradient and variable nature of the height of the nuclear pitch accent may indicate both the degree of expressiveness associated with that position, as well as the degree of susceptibility to change due to sociolinguistic factors, such as regional differences or contact with another language, as discussed below.

The remaining analyses were conducted according to origin of speaker and native languages of the speaker, in order to observe general trends within groups. More data are needed to strengthen claims at the individual speaker level. Linear regression analysis of tonal targets demonstrated some differences between the Lima and Cuzco groups, as well as between Cuzco language subgroups. Downstep of the prenuclear peak was observed for the Lima and Cuzco groups, while only the Cuzco group as a whole demonstrated downstep of nuclear peaks. However, analysis by language group showed the Cuzco native Spanish group to coincide with the Lima group in not showing a strong correlation of downstep of nuclear peaks. The Quechua-Spanish bilingual group demonstrated downstep of nuclear peaks while the native Quechua group actually showed upstep of nuclear peaks. Declination, on the other hand, does not appear to determine tonal target levels in this data set.

The calculations presented here have described how downstep and declination operate in two varieties of Peruvian Spanish. Downstep between prenuclear peaks is consistently observed for all Lima and Cuzco speakers. The height of the nuclear peak compared to the previous peak is more variable at the regional level between Lima and Cuzco, at the language group level between those with and without knowledge of Quechua, and for individual speakers. A separate analysis of downstep and declination in Quechua may indicate to what extent Quechua speakers are employing processes also present in Quechua when speaking Spanish. Compared to research on other varieties of Spanish, this study has shown that both Lima and Cuzco Spanish coincide with Madrid Spanish (Face 2001), and Mexican Spanish (Prieto et al. 1996) in showing the greatest degree of downstep between the first and second prenuclear peaks in an utterance. However, in another finding the present study differs from

these two and from the description of Dominican Spanish (Willis 2003), which show a lower final peak.<sup>7</sup>

These data on Peruvian Spanish support the claim that peak levels are determined at a local level (Prieto et al. 1996). Nonetheless, considerably more work is needed in this area before more precise predictions can be made for Peruvian Spanish regarding the exact modeling of peak heights. That is, the current study may be considered more exploratory in nature in that the findings offer an initial description of peak heights in Peruvian Spanish intonation. The elicitation materials were designed so that speakers would not fall into a specific production pattern. Therefore, words with different stress patterns (proparoxytone, paroxytone and oxytone) were used in utterance initial, medial and final position. (See Table A2 of the Appendix for the number of tokens in target utterances; see Table A3 for the number of tokens measured per position and stress pattern.) By doing so, the number of intervening stressed syllables was alternated. The desired result was achieved, in that the speakers did not seem to produce a mechanical rendition of the target utterances. Given the mixed structure of the data set, it should be interpreted with the caveat that a follow-up study controlling for the number of intervening syllables as well as lexical stress pattern is needed to further substantiate the claims made here, especially with regard to the strength of correlations between peak heights. More data points for each token type per individual speaker may allow a more detailed examination of the phenomenon currently observed.<sup>8</sup> What this study has served to demonstrate is that level and upstepped prenuclear peaks are employed in read speech for these Peruvian Spanish speakers. Variation is found both in Lima and Cuzco, such that several factors (linguistic, pragmatic, and sociolinguistic) may need to be explored in order to explain this use in Peruvian Spanish.

## Appendix

<i>No. of syllables between stressed syllables</i>			
<b>Core sentences in Spanish</b>	<b>S-V</b>	<b>V-O</b>	<b>English Translation</b>
1. <i>Amalia podaba los árboles.</i>	2	2	Amalia used to prune the trees.
2. <i>Su madre admira la lana.</i>	2	2	Her mother is admiring the wool.
3. <i>Su hermana retirará la demanda.</i>	4	2	Her sister will withdraw the complaint.
4. <i>El niño añade los rábanos.</i>	2	2	The child is adding the radishes.
5. <i>Su familia mandará los violines.</i>	3	2	His family will send the violins.
6. <i>Bernardo venderá los mangos.</i>	3	1	Bernardo will sell the mangos.
7. <i>Yolanda domina el castellano.</i>	2	4	Yolanda is fluent in Spanish.
8. <i>El criminal llevaba el ídolo.</i>	1	2	The criminal was carrying the idol.
9. <i>El albañil moverá los barriles.</i>	2	2	The mason will move the barrels.
10. <i>El vándalo agarra los baldes.</i>	3	2	The vandal is grabbing the buckets.

<sup>7</sup> While a comparison across studies is made in order to observe similarities and differences, it is important to note that the data set that is analyzed in each study is different. For example, in Prieto et al. (1996), multiple subsequent peaks are measured in an NP, a design which is similar to previous research on English. In Face (2001), prenuclear peaks and nuclear peaks appear in utterances with an NP and VP for one data set, and in subordinate clauses headed by a complement for another data set. In Willis (2003), a prenuclear-to-nuclear peak height comparison is made for utterances consisting of either an NP followed by a verb, or a verb followed by an NP. A possible factor that needs to be further explored is whether the height of the final peak (e.g., whether it is downstepped or not) in Spanish may be affected by the type of phrase or utterance in which it appears, given the difference in pragmatic conditions present for each test condition. Grabe (1998) observed cross-linguistic differences in the height of the final peak in German as compared to English read speech. Similarly, cross-dialectal differences in final peak height may also be possible for different varieties of Spanish.

<sup>8</sup> As an example, a subset of words with paroxytonic stress which had two preceding unstressed syllables was extracted and a correlation analysis was conducted similar to that in Section 3.2. This particular stress pattern and preceding syllable number was chosen because it is the most predominant in the data set (For medial position, 4 paroxytones with two intervening syllables x 2 productions=8 tokens; for final position, 6 paroxytones with two intervening syllables x 2 productions=12 tokens per speaker). The results are shown in Table A5 and Table A6 of the Appendix, which coincide with general trends in the data reported above.

11. <i>El <u>á</u>guila <u>guard</u>aba el <u>n</u>ido.</i>	3	2	The eagle was guarding the nest.
12. <i>La <u>y</u>ibora <u>devor</u>aba los <u>anim</u>ales.</i>	4	4	The snake was devouring the animals.
Avg.	2.6	2.3	

**Table A1.** Target utterances in Spanish. Stressed syllable is underlined in Spanish.

	S	V	O	Total
Proparoxytone	3		3	6
Paroxytone	7	8	9	24
Oxytone	2	4		6
Total	12	12	12	36

**Table A2.** Lexical stress pattern of target words in utterances, according to position. (S=Subject in initial position, V=Verb in secondary position, O=Object in utterance-final position)

LIMA (all) Stress pattern	H1 (N)	%	H2 (N)	%	H3 (N)	%	CUZCO (all) Stress pattern	H1 (N)	%	H2 (N)	%	H3 (N)	%
Proparoxytone	26	26%			27	29%	Proparoxytone	72	24%			69	25%
Paroxytone	57	56%	51	60%	67	71%	Paroxytone	171	58%	164	66%	212	75%
Oxytone	18	18%	34	40%			Oxytone	52	18%	86	34%		
Total	101		85		94		Total	295		250		281	

**Table A3.** Number of tokens measured per position, according to lexical stress pattern.

LIMA (all) intervening syllables	H1-H2 (N)	%	H2-H3 (N)	%	CUZCO (all) intervening syllables	H1-H2 (N)	%	H2-H3 (N)	%
1	3	4%	10	11%	1	18	7%	26	9%
2	51	60%	71	76%	2	147	59%	208	74%
3	22	26%	6	6%	3	61	24%	23	8%
4	9	11%	7	7%	4	24	10%	24	9%
Total	85		94		Total	250		281	

**Table A4.** Number of tokens measured per position, according to number of intervening stressed syllables between two adjacent peaks.

LIMA (all)	R	R <sup>2</sup>	N	P	CUZCO (all)	R	R <sup>2</sup>	N	P
H2 vs. H1 (Hz)	0.854	0.730	33	<0.0001	H2 vs. H1 (Hz)	0.890	0.792	101	<0.0001
H3 vs. H2 (Hz)	0.123	0.015	35	0.4822	H3 vs. H2 (Hz)	0.701	0.491	110	<0.0001

**Table A5.** *Data subset.* Correlation coefficients R and R squared of peak height with previous peak height for Lima and Cuzco groups; calculations are based on a subset of the data consisting of words with paroxytonic stress that were preceded by two unstressed syllables.

Linear regression	H2 vs. H1		H3 vs. H2		Linear regression	H2 vs. H1		H3 vs. H2	
	Slope	R	Slope	R		Slope	R	Slope	R
Group					Group				
LIMA (all)	<b>0.46</b>	0.854	0.17	0.123	LIMA (all)	<b>0.46</b>	0.854	0.17	0.123
CUZCO (all)	<b>0.64</b>	0.890	<b>0.71</b>	0.701	CUZCO (all)	<b>0.64</b>	0.890	<b>0.71</b>	0.701
CUZCO (SP)	<b>0.63</b>	0.790	0.77	0.632	CUZCO (X)	<b>0.65</b>	0.883	<b>0.69</b>	0.915
CUZCO (QU/SP)	<b>0.65</b>	0.903	<b>0.50</b>	0.698	CUZCO (Y)	<b>0.70</b>	0.857	<b>0.87</b>	0.853
CUZCO (QU)	<b>0.73</b>	0.970	<b>1.14</b>	0.883	CUZCO (Z)	<b>0.59</b>	0.894	<b>1.12</b>	0.808

**Table A6.** Data subset. Slope of linear regression best fit line for Lima and Cuzco groups, and for language and pattern subgroups. Slope values in bold correspond to  $R > 0.7$ . Lower slope values indicate greater downstep to subsequent tonal targets. Calculations are based on a subset of the data consisting of words with paroxytonic stress that were preceded by two unstressed syllables. (SP=native Spanish speakers, QU/SP=native Quechua/Spanish bilingual speakers, and QU=native Quechua speakers; X=Pattern X, Y=Pattern Y, Z=Pattern Z)

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# Selected Proceedings of the 2nd Conference on Laboratory Approaches to Spanish Phonetics and Phonology

edited by Manuel Díaz-Campos

Cascadilla Proceedings Project Somerville, MA 2006

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