Looking for the Spanish Imperative Intonation: Combination of Global and Pitch-Accent Level Strategies

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1. Introduction

It is well known that in Spanish, pitch is used to convey different pragmatic meanings. Recent studies show that Spanish dialects have different ways of expressing imperativity. However, declarative and imperative intonations have also been equated.

Navarro Tomas (1944) suggests that Spanish employs more than just grammatical resources to denote imperativity and states that the so-called *entonación volitiva* can make the distinction between declarative and imperative sentences. He subdivides volitional intonation in different types that range from a regular command or a suggestion to an exhortation, an order or a stronger petition. He also defends "an amplification of tone inflections and an increase of expirational effort and of muscular tension" and asserts that imperatives have a wider tonal range and more intensity. Kvavik (1988) questions these descriptions in a study with four English-Cuban Spanish bilingual females. After comparing twenty-eight pairs of declarative/imperative sentences she concludes that there is "no clear imperative vs. declarative sentence prosody". She generally finds higher F0 peaks in imperatives but the frequency range (difference between F0 maxima and minima) is not necessarily wider in these. Willis (2002) looks for the difference between the two kinds of sentences (eleven of each kind x three repetitions) at the pre-nuclear pitch-accent level in Mexican Spanish. He identifies two kinds of alignments: L+H* and L*+H. He calls the former 'early peak' because the F0 peak is reached within the boundaries of the tonic syllable and the latter 'late peak' because the F0 peak is reached in the post-tonic syllable.[1] He notices that although both alignments are found in the two kinds of sentences, imperatives have a higher use of early peaks. He also observes an increased local tonal range in imperatives but this is not significant for all speakers. He concludes that, at least in a laboratory setting, the intonation marking of a Spanish imperative utterance is not categorical, although some local intonation cues can be found. In a more recent work, Prieto and Roseano (2010) present a compilation of imperatives in different dialects of Spanish that confirms previous findings and also shows new ones. For example, Estebas-Vilaplana and Prieto (2010) notice that strong commands are produced with an expanded pitch range and that in Castillian Spanish their nuclear configuration is L+H* M%. López -Bobo and Cuevas-Alonso (2010) find a nuclear H+L* L% configuration preceded by L+H* or L+>H* (early and late H according to Willis) depending on the illocutionary force in Cantabrian Spanish. Similar configurations are also found in Dominican Spanish (Willis 2010), Ecuadorian Andean Spanish (O'Rourke 2010) and Argentinian Spanish (Gabriel et al. 2010). Finally, other varieties like Canarian Spanish (Cabrera Abreu and Vizcaíno Ortega 2010) use high boundary tones (L+H* HH%) to express imperativity.

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[1] This alignment has been relabeled as L+>H* in late works (see Face and Prieto 2007 and Estebas-Vilaplana and Prieto 2008 for more details)

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This work presents data on imperatives produced by speakers from different areas of Spain and compares it to those in the aforementioned studies. It also shows how intonational strategies at the pitch-accent level can complement or substitute strategies at the global level of the sentence when building an imperative utterance in different contexts in Peninsular Spanish. Finally, a perceptual experiment shows the preference of certain strategies over others to express imperativity.

2. Production study: design, methods and participants

Eleven pairs of ambiguous sentences (declarative/imperative) were chosen for the experiment. All the sentences have a verb at the beginning and what I will call a "content word" at the end. This content word can be a direct object or a prepositional phrase that accompanies the verb. Sentences with this structure were chosen because i) according to Kvavik (1988), Navarro Tomas (1944) describes regular commands as short and snappy and ii) Kvavik (1988) and Willis (2002) use sentences of similar length in their studies and it is desirable to be able to compare the results. The height of the pitch was measured at four different points for every sentence: b1, p1, b2 and p2. These points correspond to the following in statements (Figure 1):

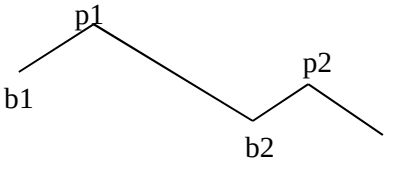


Figure 1: Points where F0 was measured
b1 = beginning of the F0 rise in the pre-nuclear word.
p1 = F0 peak in the pre-nuclear word.
b2 = beginning of the F0 rise in the nuclear word.
p2 = F0 peak in the nuclear word.

In order to be able to measure the actual difference in pitch between statements and imperatives, b1, p1, b2, and p2 are located at the same points in both. The differences in F0 between the valleys and the peaks in both pitch-accents (verb and content word) are captured by excursion 1 (exc1) and excursion 2 (exc2). In cases where there were falls without pitch rises, F0 values were not measured.

Nine male Spanish speakers from different areas of the Iberian Peninsula - 2 from Bilbao (ir, jf), 2 from Alicante (pl, on), 2 from Jaen (sg, jg), 2 from Pamplona (af, pr) and 1 from Madrid (sf) - were recorded in single sessions that lasted from 30 to 50 minutes.[2] Their task was to give a natural spoken response to a given context by using information that was provided in PowerPoint slides. There were four different contexts and therefore four different kinds of spoken responses: a declarative, an imperative (Imp1), a repetition of an imperative (Imp2) and an "angry" imperative (Imp3).[3] As it has been mentioned before, Navarro Tomas (1944) presents a wide range of possible commands under the so-called volitional intonation. In addition, he notices that imperatives are manifested spontaneously only in a few cases. Thus, it is possible that subjects may use different strategies or modify existing ones for each of the imperative contexts.[4] The contexts were presented in different blocks except Imp1 and Imp2 since the context of the latter was provided by the former. Participants were presented with each sentence twice in random order for each of the contexts. When the researcher noticed that speakers were using more than one pitch configuration for a context, the slides were presented again in order to gather more instances of each pitch configuration. The different numbers of instances for each context result from this fact. Only productions with F0 tracking errors due to creaky voice or similar problems were discarded. This yielded a total number of 662 utterances divided as follows: 103 declarative sentences, 201 imperatives in Imp1, 173 imperatives in Imp2 and 185 imperatives in Imp3. The Praat speech analysis program (Boersma and Weenink 2009) was used to analyze the data.

3. Results

3.1. Declarative context

All nine participants produced declarative sentences that follow what can be considered the

[2] Speakers from different areas were chosen to see the differences and similarities of imperatives within Peninsular Spanish. Four speakers were recorded at the University of Southern California and five in Spain.
[3] All the sentences can be found in Appendix A and an example in different contexts in Appendix B.
[4] Prieto and Roseano (2010) also use imperatives of different illocutionary strength (commands vs. requests).

standard pattern (Hualde 2005): the F0 rises in the first stressed syllable and reaches its maximum height in the post-tonic syllable (L+>H*).[5] From this point onwards the pitch falls gradually and even the nuclear syllable shows a smaller pitch rise and a lower pitch overall. Beckman et al. (2002) and Ortiz et al. (2010) find the same configuration in neutral statements in Castilian and Chilean Spanish respectively so I follow their notation and use "!" (L+!H*) to mark the decrease in F0 peak height (i.e. downstep). The utterance ends in a low boundary tone (L%). Figure 2a shows this L+>H* L+!H* L% configuration:

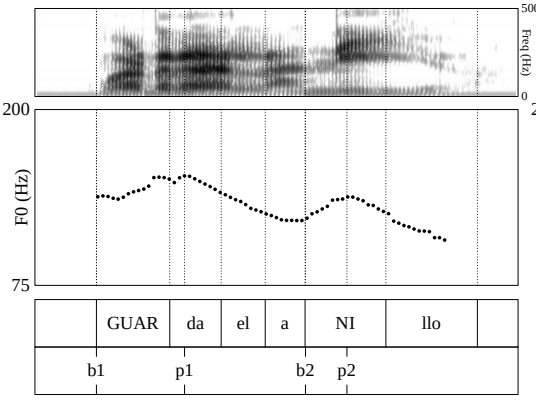


Figure 2a: *Guarda el anillo* "S/he hides the ring"
Speaker ir
Declarative with L+>H* L+!H* L% configuration[6]

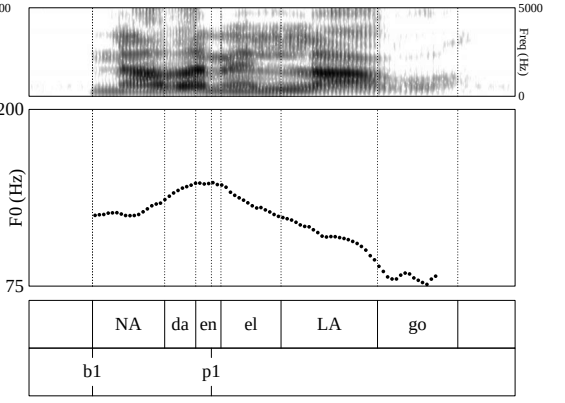


Figure 2b: *Nada en el lago* "S/he swims in the lake"
Speaker on
Declarative with L+>H* L* L% configuration

Two subjects produced utterances that did not have a second peak (L+H*) but a fall throughout the nuclear syllable as shown in Figure 2b. Estebas-Vilaplana and Prieto (2010) also notice this nuclear configuration in declaratives in Castilian Spanish and label it as L* L%.[7] Out of the 103 utterances produced in the declarative context, 94 (90.9%) presented the first pattern and 9 (9.1%) the second pattern. No other patterns were attested. Both patterns were found in the three imperative contexts as well, along with additional patterns specific to the imperatives.

3.2. Imperative contexts

3.2.1. Global configurations

L+>H* L+!H* L% and L+>H* L* L% configurations were found also in Imp1, Imp2 and Imp3 contexts. The number of utterances with the L+>H* L+!H* L% pattern decreased from 90.9% in the declarative context to 41.14%, 42.38% and 44.81% in the Imp1, Imp2 and Imp3 contexts respectively (see Table 1) due to the use of other patterns. Interestingly, one of these patterns was L+>H* L* L%. Its use increased from 9.1% in the declarative context to 34.73% in Imp1 and 14.84% in Imp3. In Imp2 only 5.83% of the utterances showed this pattern (see Table 1). This can be explained by the use of other imperative configurations as I will show later in this section.

[5] A few pre-nuclear pitch accents can be argued to have a late rise (L*+H) as discussed in Face and Prieto (2007), Estevas-Vilaplana and Prieto (2008) and Prieto and Roseano (2010).
[6] Capital letters in the figures mark that the syllable is accented.
[7] It is unlikely that the continuous F0 fall is provoked by an undershooting of the L in a L+H* tone due to an increased F0 in the pre-nuclear pitch-accent as the F0 values of pre-nuclear pitch-accents produced by the same speakers were similar in sentences that actually had clear nuclear L*+H configurations. López -Bobo and Cuevas-Alonso (2010) argue that H+L* can be phonologically interpreted as L*. Similarly, Hualde (2005) labels this configuration as H+L* L% and Estevas-Vilaplana and Prieto (2008) propose a H+L* vs. L* distinction in absolute questions. Also, as suggested by an anonymous reviewer, the fall could be due to deaccentuation (Rao 2006). Although the H+L* notation is possible, I follow Estevas-Vilaplana and Prieto (2010) and Gabriel et al. (2010) and label it as L* L% due to the similarities between the pitch contours they present and the ones found in the current study.

All nine subjects used this kind of pattern in at least one of the imperative contexts while only two used it in the declarative context. This means that there is a notable tendency to use utterances with nuclear pitch-accents that show no F0 rises to express imperativity in Peninsular Spanish. This is not surprising since imperatives with F0 descents from the pre-nuclear peak to the boundary tone are also found in Cantabrian (López -Bobo and Cuevas-Alonso 2010), Argentinian (Gabriel et al. 2010) and Dominican Spanish (Willis 2010).

Subject	Declarative		Imp1		Imp2 (repetition)		Imp3 (angry)	
	L+!H*	L*	L+!H*	L*	L+!H*	L*	L+!H*	L*
pr	100%	0	83.3%	0	18.2%	0	0	47.6%
ir	100%	0	35.3%	41.2%	78.7%	0	61.5%	0
af	100%	0	3%	6.1%	3.1%	0	27.3%	9%
sg	63.6%	36.4%	27.8%	50%	31.2%	25%	37.5%	15.6%
sf	100%	0	8.7%)	65.2%	10%	23.3%	8.4%	45.8%
jg	100%	0	71.5%	21.4%	50%	0	68.2%	4.5%
on	54.5%	45.5%	24%	72%	80%	0	44.5%	11.1%
pl	100%	0	61.5%	15.4%	72.7%	0	63.6%	0
jf	100%	0	55.2%	41.3%	37.5%	4.2%	92.3%	0
Total	**90.9%**	**9.1%**	**41.14%**	**34.73%**	**42.38%**	**5.83%**	**44.81%**	**14.84%**

Table 1: Percentage of utterances with L+!H* L% and L* L% nuclear configurations by speaker and context

It is important to highlight that 24.22 % of the utterances produced in the Imp1 context, 51.79 % in the Imp2 context and 40.35% in the Imp3 context do not correspond to any of the two patterns found in the declarative context. Most of these new patterns can be described as modifications of the standard L+>H* L+!H* L% configuration. For example, many of the utterances produced in the imperative context lacked downstep, and the peak of the nuclear pitch-accent had similar F0 values to the pre-nuclear pitch-accent (Figure 3). In other cases, the peak of the nuclear pitch-accent was notably higher than the one of the pre-nuclear pitch-accent (Figure 4). Following Estebas-Vilaplana and Prieto (2010), Willis (2010) and Ortiz et al. (2010) I use upstep (¡) to indicate that the nuclear peak is higher.

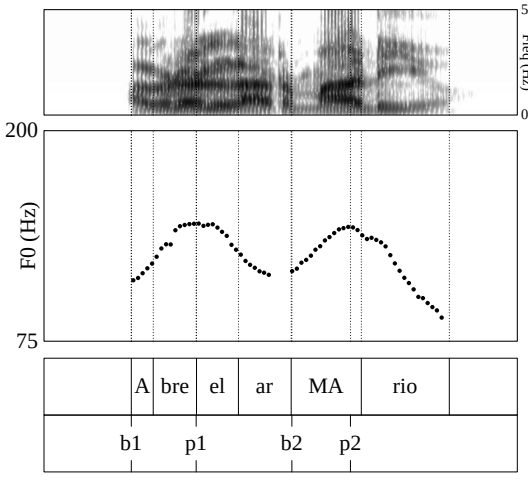


Figure 3: *Abre el armario* "Open the closet"
Speaker af
Imperative with L+>H* L+H* L% configuration

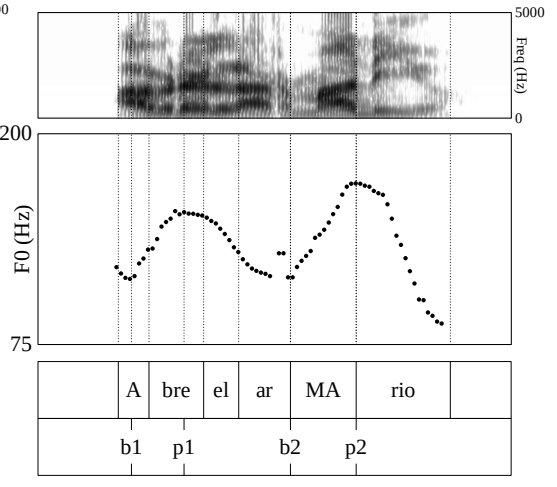


Figure 4: *Abre el armario* "Open the closet"
Speaker pr
Imperative with L+>H* L+¡H* L% configuration

In order to establish a limit between configurations and have a tentative classification, utterances with nuclear pitch-accents 5 Hz lower than the pre-nuclear pitch-accents were labeled as utterances with downstep (already presented in Table 1). When the nuclear pitch-accent was 5 Hz higher than the pre-nuclear pitch-accent utterances were labeled as utterances with upstep (L+>H* L+¡H* L%). Utterances in between (with similar F0 values in the pre-nuclear and nuclear pitch-accents) were labeled as utterances with F0 maintenance (where the F0 height was maintained and there was no

downstep or uptep: L+>H* L+H* L%).[8] The number of instances with these configurations is presented in Table 2.

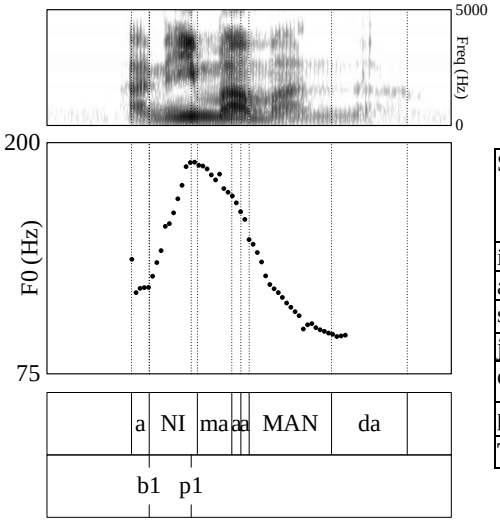
Although patterns with downstep were the most common ones in the three imperative contexts (41.14%, 42.38% and 44.81% as shown in Table 1), the use of both maintenance and upstep was also notably high, especially in the Imp2 context. One possible explanation for the use of maintenance or upstep as opposed to configurations with an F0 fall in Imp2 is that the repetition context has a secondary effect. Nonetheless, the fact that all subjects used maintenance and upstep at some point in the three imperative contexts but never in the declarative context clarifies that the height of the nuclear pitch-accent with respect to the pre-nuclear pitch-accent can be modified in order to achieve an imperative intonation. This observation agrees with previous works. Kvavik (1988) mentions that in some cases the highest F0 value of the sentence was located not in the verb or the post-stressed syllables, but rather, in the last stressed syllable of the utterance. Similarly, Garrido (1991) finds volitional utterances where the last F0 peak is the highest and presents pitch contours identical to Figure 4.

Subject	Declarative		Imp1		Imp2 (repetition)		Imp3 (angry)	
	Maint.	Upstep	Maint.	Upstep	Maint.	Upstep	Maint.	Upstep
pr	0	0	16.7%	0	72.7%	9.1%	14.4%	38%
ir	0	0	8.8%	2.9%	14.2%	7.1%	15.4%	23.1%
af	0	0	21.2%	54.5%	0	50%	4.6%	36.4%
sg	0	0	16.7%	5.5%	31.2%	6.3%	6.2%	0
sf	0	0	17.4%	8.7%	36.7%	20%	20.8%	4.2%
jg	0	0	7.1%	0	15%	15%	9.1%	0
on	0	0	0	4%	0	20%	3.7%	0
pl	0	0	15.4%	0	9.1%	9.1%	36.4%	0
jf	0	0	3.5%	0	4.2%	54.1%	7.7%	0
Total	**0(0%)**	**0(0%)**	**11.86%**	**8.5%**	**20.36%**	**21.2%**	**13.15%**	**11.3%**

Table 2: Percentage of utterances with maintenance and upstep configurations by speaker and context

3.2.2. Peak alignments

Peak alignments were determined by visually inspecting the location of the highest F0 value with respect to the stressed syllable. Early peaks in the verb (i.e. F0 peak is reached within the limits of the stressed syllable - L+H*) were found in Imp2 and Imp3 contexts, but never in declaratives or Imp1.



< **Figure 5:** *Anima a Amanda* "Cheer Amanda up"
Speaker sf
Imperative with L+H* L* L% configuration

Subject	Imp1		Imp2		Imp3	
	L* H%	L+¡H* H%	L*H%	L+¡H* H%	L*H%	L+¡H* H%
ir	11.8%	0	0	0	0	0
af	15.2%	0	25%	18.8%	13.5%	4.6%
sf	0	0	0	3%	0	0
jg	0	0	5%	15%	9.1%	9.1%
on	0	0	0	0	0	40.7%
pl	7.7%	0	9.1%	0	0	0
Total	**3.86%**	**0%**	**4.34%**	**4.08%**	**2.5%**	**6%**

Table 3: Number of utterances with H% by speaker and context. (pr, sg and jf did not produce any H%)

[8] A similar three way classification is used by Ortiz et al. (2010) to distinguish levels of prominence in biased statements in Chilean Spanish. It is not my intention to define three completely different phonological patterns, but to have a tentative classification to compare production and perception results as I will show in section 4.

These kinds of peak alignments were produced by only two of the speakers: sf (the only speaker from Madrid) and sg. Speaker sf produced this kind of pattern twice in Imp2 (7% of sf's total in this context) and five times in Imp3 (20.8%). Speaker sg produced this kind of pattern once in Imp2 (6.3%) and thirteen times in Imp3 (40.7%). Only three of the utterances produced by sg in Imp3 (9.4%) had a L+H* L+!H* L% configuration. The rest of the utterances by sg and sf had a fall through-out the nuclear syllable (L+H* L* L% - Figure 5). Interestingly, López -Bobo and Cuevas-Alonso (2010) also find early peaks in pre-nuclear pitch-accents followed by pitch falls until the end of the utterance.[9]

Willis (2002) found early peaks both in declaratives and imperatives in Mexican Spanish and noticed that they were more common in the latter. In the current Peninsular Spanish data early peaks are non-existent in declaratives and occur only in imperatives.

3.2.3. Boundary tones

In the current study declaratives always end in a low boundary tone (L%). This kind of boundary tone is found also in all imperative contexts. Nevertheless, six of the nine subjects used a high boundary tone (H%) at some point when producing imperative utterances. Interestingly, high boundary tones were combined with three different nuclear pitch-accents presented before: L* (Figure 6), maintenance (L+H*) and upstep (L+¡H* - Figure 7). Although speaker af produced one sentence with maintenance and a high boundary tone (L+H* H%) in Imp2 (3.1%) and one in Imp3 (4.6%), L* and L+¡H* were the most frequent nuclear pitch-accents combined with H% (Table 3).[10]

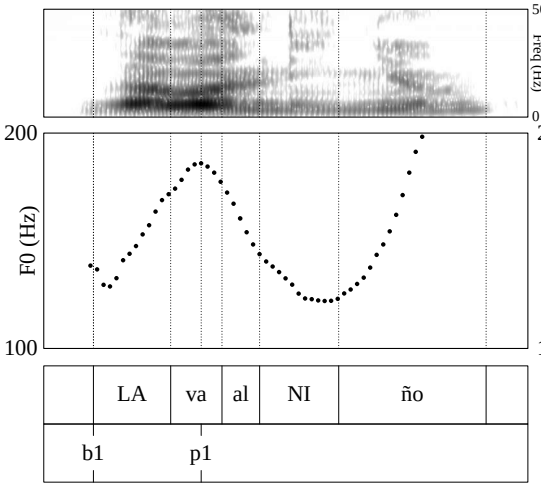


Figure 6: *Lava al niño* "Wash the kid"
Speaker af
Imperative with L+>H* L* H% configuration

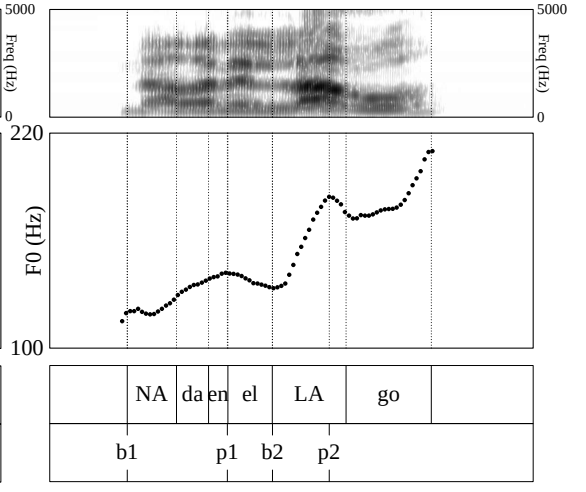


Figure 7: *Nada en el lago* "Swim in the lake"
Speaker on
Imperative with L+>H* L+¡H* LH% configuration

High boundary tones are used extensively in different kinds of interrogative sentences (see Roseano and Prieto 2010 for multiple examples). In fact, nuclear configurations like the one found in Figure 7 have been reported in confirmation questions in Caracas Spanish by Beckman et al. (2002) and by Ortiz et al. (2010) in counterexpectational yes-no question in Chilean Spanish. The use of high boundary tones in imperatives has been reported by Cabrera Abreu and Vizcaíno Ortega (2010) for Canarian Spanish (HH%); these data show that they are produced in Peninsular Spanish imperatives as well.

[9] The contour they present is almost identical but their notation is !H+L*.

[10] In a few cases complex boundary tones like LH% (Figure 7) or HH% can be proposed. These variations occurred even within the same speaker.

3.2.4. Overall F0 and excursions

At this point it is necessary to highlight that declarative patterns are widely used in imperative contexts as well (L+>H* L+!H* L%: 90.9% of declaratives and 42.77% of imperatives; L+>H* L* L%: 9.1% of declaratives and 18.47% of imperatives); but how is this possible if two different pragmatic meanings are trying to be conveyed? Kvavik (1988) and Willis (2002) agree in that there is a tendency to use higher F0 and wider excursions in imperatives than in declaratives. Estevas-Vilaplana and Prieto (2010) also argue that commands are produced with an expanded pitch range. The collected data support these assertions. The average values in Hertz of b1, p1, p2, b2, exc1 and exc2 for all the utterances with the L+>H* L+!H* L% pattern produced by the nine subjects in the four contexts are in Table 4.Although the declarative context and the first imperative context show similar results, in the second imperative context and especially in the third one, imperativity emerges through a rise in the overall F0 and enlarged excursions. A Wilcoxon signed-rank test revealed that significant differences ($p < .05$) between declarative and imperative F0 values were found only for Imp2 and Imp3 contexts.[11] Section 4 will demonstrate the perceptual relevance of these differences.

	b1	p1	exc1	b2	p2	exc2
Declarative	121.26	141.40	20.13	111.82	118.23	6.4
Imp1	120.91	142.48	21.57	117.87	124.92	7.1
Imp2	122.34	158.37	36.02	122.36*	135.39*	13.02
Imp3	127.93*	163.63*	35.69*	126.64*	138.64*	11.99

Table 4: F0 means of all the utterances with L+>H* L+!H* L% configuration.'*' marks statistically significant differences between declaratives and imperatives[12]

This study shows that although higher F0s and wider excursions are not always present in imperatives, there is a clear tendency to use higher values in the F0 continuum as the contexts require a clearer imperative. Moreover, a number of imperative variables emerge in all imperative contexts, particularly in Imp2 and Imp3. Therefore, an imperative that has a lower F0 than a declarative may have a different variable (eg. upstep, a high boundary tone, or both) that marks imperativity.

3.2.5. Combination of imperative variables

If continuous variables like high F0 and wider F0 excursions are left aside and the configurations found in declaratives are considered to have no imperative variables, it is also clear that variables co-occur more frequently in clearer imperative contexts (Table 5):

	0 variables	1 variable	2 variables
Declarative (103)	100%	0%	0%
Imp1 (201)	75.87%	24.13%	0%
Imp2 (173)	48.21%	47.37%	4.42%
Imp3 (185)	59.65%	33.79%	6.56%

Table 5: Number of imperative variables per context

In the current study declaratives do not have imperative variables (maintenance, upstep, early peaks or H%). In Imp1 only 24.13% of the productions show one imperative variable. This is interesting because, as has been pointed out before, F0 in this context was not higher than in declaratives. In Imp2 contexts, the number of variables is larger, and in 4.42% of the cases, two variables are found. This number grows up to 6.56% in Imp3. It is important to remember that in this context, F0 was also higher and excursions were wider; therefore, some utterances had up to four imperative variables (Figure 7 is an example). This means that multiple F0 levels of an utterance can be combined in order to get an imperative intonation. As important as the combination of some variables was the lack of co-occurrence of other variables. For example, there were no instances of nuclear L+¡H* with pre-nuclear pitch-accent alignments other than L+>H*. These gaps are probably due to their incompatibility and difficulty in the production of certain F0 movements in the same

[11] Higher F0 values and wider excursions in Imp2 and Imp3 contexts were consistently found in other configurations like L+>H* L* L% or those with upstep as well.

[12] Only the same utterances produced by the same speakers in different contexts were compared (declarative vs. Imp1, declarative vs.Imp2 and declarative vs.Imp3).

utterance although future research is necessary to explore this possibility.

It is important to highlight that there was no imperative variable that was uniquely used by one of the participants or by participants of the same region; consequently it seems that imperative variables are equally available in different varieties of Peninsular Spanish. Nevertheless, productions differed in number. This indicates that the implementation of some imperative variables is more productive than the implementation of others. A perception test was carried out in order to test the effectiveness of each of the variables and to verify their roles as correlates of imperativity.

4. Perception Study

Thirteen participants who did not take part in the production study took part in the perception study: 2 from Madrid (sc, as), 3 from Valladolid (vp, bp, pm), 1 from Valencia (hs), 1 from Granada (mv), 1 from Pamplona (po), 4 from Bilbao (jc, aj, ia, il) and 1 from Cantabria (jo). Two sentences used in the production study - *Abre el armario* (s/he opens the closet or open the closet) and *Barre la nave* (s/he cleans the warehouse or clean the warehouse) - were chosen for the perception study. Both of them were modified with PRAAT (Boersma and Weenink, 2009) such that they contained the imperative variables presented in the previous section: 1) Higher F0 and wider excursions, 2) an early peak in the pre-nuclear pitch-accent, 3) a high boundary tone, 4) F0 maintenance (F0 peaks of the same value) and 5) F0 upstep (nuclear F0 peak higher than pre-nuclear F0 peak). An extra manipulation (6) consisted of the simultaneous implementation of the following variables: A higher F0 with wider excursions, upstep and a high boundary tone. This stimulus was included because this was the largest combination of imperative variables found in the production study. Another two stimuli (7, 8) with the configurations found in the statements (L+>H* L+!H* L% and L+>H* L* L%) were also added.

All the modifications of the F0 values and peak and valley alignments to create the stimuli were based on the data obtained in the production experiment. The utterances that were used as the base for all the manipulations were produced in a declarative context by speakers sf and pr. In order to create stimuli with no imperative variables, they were slightly modified so that their b1, p1, b2 and p2 values were the same as the F0 averages obtained in the production experiment in the declarative context (see Table 4). The average values of the Imp3 context (see Table 4) were used for the stimuli with high F0 and wider tonal ranges. In the case of the stimuli with an F0 fall in the content word, the pitch fall from p1 to b2 was prolonged until the end of the utterance was reached in order to have no second peak. Stimuli with maintenance were created by matching the height of the peak of the second pitch-accent to that of the verb. In the case of upstep, the second peak was modified so that it was 18 Hz higher than the F0 peak in the verb (the average difference found in Imp1 context for this configuration). In both stimuli with maintenance and stimuli with upstep, the F0 values of the first peak were the same as for all the other stimuli (i.e. the ones in Table 4 for the declarative context). Stimuli with high boundary tones were the same as those with downstep, with the modification that the pitch raised from the end of the stressed syllable of the last word to the end of the utterance. The height of the boundary tone was the same as the average of the high boundary tones found in L* H% configurations in the production part of the experiment (158 Hz). Stimuli with upstep, H% and high F0 required further modifications. The verb had the same properties as stimuli with high F0 and the upstep was again obtained by making p2 18 Hz higher than p1. Following the same procedure as for stimuli with H%, F0 upward movements were created in the last syllable of the sentences to obtain high boundary tones. Their values were 5 Hz higher than the F0 peak of the second pitch-accent to mimic the results found in the production study.

All the valley and peak alignments were kept constant except when it was necessary to create the stimuli with early peaks in the verb. For all the stimuli, b1 was at the beginning of both utterances since both started with an accented syllable. Because the base sentences were declaratives and p1 was always located in the post-nuclear syllable (L+>H*: a<u>bre</u>, ba<u>rre</u>), the early alignment (L+H*) was created by moving it to the middle of the vowel (measured in ms) of the accented syllable (<u>a</u>bre, b<u>a</u>rre).

The main reason to use artificial stimuli was to keep all the variables constant except for those being tested.[13] This method avoids interferences from other potential variables that may serve as

[13] Artificial stimuli were compared with natural ones by a trained phonetician and a naïve native speaker of Madrid Spanish to make sure they sounded similar.

correlates of imperativity. Participants had to rate each utterance from 1 (does not express imperativity) to 5 (expresses imperativity). Stimuli were played at random order and each variable was played six times for each sentence. Thus, each variable was graded a total of 156 times (2 sentences x 6 repetitions x 13 subjects).

Results show that the weight of variables as correlates of imperativity is not the same.[14] The best variable to express imperativity turned out to be a high F0 with a wide tonal range (Avg. of 3.95 and SD of 1.01). This result is important because it validates the design of the production experiment; utterances with a higher F0 in Imp2 and Imp3 contexts could be argued to be produced due to discourse related factors (repetition and anger) and not imperativity. Nevertheless, if stimuli with high pitch values received the highest grades as correlates of imperativity, there is no reason to believe that a higher F0 is implemented uniquely due to discourse requirements not related to imperativity. Moreover, this result also demonstrates that the grammar needs to deal with phonetic variables that are not discrete (like an F0 continuum) to distinguish declaratives and imperatives.

Stimuli with pitch falls throughout the nuclear syllable of the content word also received high grades in general (Avg. of 3.82 and SD of 1.32). This result, together with the production data, reveals that L* L% nuclear configurations are more likely to be used in imperatives than in declaratives in Peninsular Spanish.

High boundary tones were clearly dispreferred as correlates of imperativity (Avg. of 2.75 and SD of 1.2). Some subjects commented that utterances with H% sounded like questions, which is not surprising given that most varieties of Spanish present H% in absolute questions (see Sosa 1999, Hualde 2005 or Prieto and Roseano 2010 for examples). This may be one of the reasons why three of the subjects consistently rated stimuli with multiple imperative variables (upstep, high F0 and H%) as non-imperatives and their final average grade was only 3.26 with a SD of 1.57. Early peaks (L+H*) received low grades as well (Avg. of 2.75 and SD of 1.22). This means that in Peninsular Spanish, as discussed in section 3.2.2, early peaks seem to need a F0 fall in the nuclear pitch-accent to express imperativity.[15]

Stimuli with similar peak values in the pre-nuclear and nuclear pitch-accents (maintenance) and with higher values in the nuclear pitch-accent (upstep) received similar grades (Avg. of 3.54 and SD of 0.99 and Avg. of 3.61 and SD of 1.12 respectively), which suggests that speakers equate both configurations with the expression of imperativity. Since upstep received slightly higher grades than maintenance and both of them received higher grades than downstep (Avg. of 3.03 and SD of 1.21), it seems that the p2-p1 difference continuum is closely related to the imperativity expressed and that the downstep-maintenance-upstep classification may be a simplification (i.e. the higher the second peak is with respect to the first one the more imperativity it is expressed). Nevertheless, in order to obtain a more precise picture of how the grammar actually works, it would be necessary to present speakers with several stimuli extracted from this downstep-upstep continuum and see if the degree of imperativity actually rises as the second peak has higher F0 values (in a similar way as imperativity rises with increases in the global F0 or tonal range). Finally, the rating for downstep as correlate of imperativity was moderate (Avg. of 3.03 and SD of 1.21). This result is revealing and interesting since previous studies (Kvavik 1988 and Willis 2002) and this one have shown that this configuration can be equally used in declaratives and imperatives.

A one-way ANOVA revealed that the differences between the means of the grades stimuli received were significant ($p < .05$). A post-hoc multiple comparison (Tukey) of the means of the acceptability of each stimulus as correlate of imperativity was performed. Due to their double interpretation, stimuli with downstep can be considered a reference point, and we can expect that any variable with a real imperative value should receive significantly higher grades than these. Stimuli with a F0 fall throughout the nuclear pitch-accent, with a high F0, with maintenance and with upstep received the highest grades (3.5 and up) and showed means significantly different from downstep ($p < .05$). Stimuli with all variables and with early peaks did not show significantly different means. Finally, stimuli with high boundary tones showed significantly different means from downstep due to

[14] See Appendix C for individual results.

[15] As pointed out by Willis (2002) when analyzing imperatives in Mexican Spanish, early peaks can signal contrastive focus as well. Thus, speakers in the current study may have graded stimuli with early peaks as non-imperatives because they perceived them as declaratives sentences with focus.

the lower grades they received. As discussed above, this result is probably due to extended use of H% in absolute questions in Peninsular Spanish.

5. Conclusions and final remarks

This is the first study that analyzes the intonation of imperatives in several varieties of Peninsular Spanish by combining both production and perception. The contrast between the acceptability of the different variables as correlates of imperatively was reflected in both parts of the experiment. Utterances with F0 falls in the content word, maintenance and upstep were the most commonly produced in imperative contexts. These were precisely the variables that were consistently rated as the best correlates of imperativity in the perception study. In contrast, other variables that were produced less often, such as early peaks or high boundary tones, were generally rated as poorer examples of imperativity. Configurations with downstep were the most common in imperative contexts and their acceptance as correlates of imperativity varied from medium to high. As presented in section 2.1.2 and confirmed by the perception study, higher F0 values and wider tonal ranges were preferred over lower F0 values and narrower tonal ranges to express imperativity with this configuration (3.96 vs. 3.03). All these observations hold generally among all the speakers and Peninsular varieties tested.

Following the line of research of Kvavik (1988) and Willis (2002), the current study has confirmed that the link between statements and imperatives is irrefutable and that declarative-like F0-patterns can be used instead of more complex ones to express imperativity; however, when there is an extra need to convey an imperative meaning, they are abandoned and well established suprasegmental variables of imperativity that combine at the global and local pitch-accent level emerge. Thus, we cannot talk about *a* unique and categorical Spanish imperative intonation, but about various phonetic modifications that result in several F0 configurations that express imperativity and that clearly differ from declaratives. This study has also shown that in cases where both F0 configurations are the same in declaratives and imperatives, higher F0 values tend to be found in imperatives. All these observations and the attested configurations confirm that previous findings on the intonation of Spanish imperatives can be extended to the varieties of Peninsular Spanish included in this study: High F0 values and wide excursions (Kvavik 1988, De-la-Mota 1995, Willis 2002, Estevas-Vilaplana and Prieto 2010), early peaks in the pre-nuclear pitch-accent (Willis 2002, López -Bobo and Cuevas-Alonso 2010), F0 falls in the nuclear pitch-accent (López -Bobo and Cuevas-Alonso 2010, Gabriel et al. 2010, Willis 2010), higher F0 values in the nuclear than in the pre-nuclear pitch-accent (Kvavik 1988, Garrido 1991) and high boundary tones (Cabrera Abreu and Vizcaíno Ortega 2010). Nevertheless, future research is necessary to determine whether variables that have been identified as imperative correlates should be treated qualitatively as discrete phonological units (L+H*, upstep, etc) or quantitatively as phonetic continua (more precise F0 alignments, Hz differences, etc).[16] If variables turn out to be continuous like F0 height, a unified analysis is possible by assuming that the degree of imperativity varies depending on the values of each of those variables. If, on the contrary, some of the variables are actually discrete (downstep vs. maintenance vs. upstep) and others are continuous (F0 height) it would be necessary to use a model that captures that grammar can deal with two kinds of variables that can affect the level of imperativity.[17]

Imperatives of different word lengths and syntactic structures should be considered for future research in order to see how some imperative variables are implemented when others cannot be present. For example, an imperative like “estudia” (study) cannot have upstep (higher F0 in the nuclear than in the pre-nuclear pitch-accent - L+¡H*) because there is only one pitch-accent. Thus, other phonetic variables (e.g. H%) may have to replace the otherwise expected ones. In future work other phonetic properties such as the amplitude or the length of productions should be examined as well to see if these can also serve as correlates of imperativity in cases where intonational differences do not exist.

[16] Estebas-Vilaplana and Prieto (2008) raise a similar question on the phonological status of L+H, L+!H* and L+¡H*.

[17] As suggested by Louis Goldstein (p.c.), the formal language of nonlinear dynamics (Gafos & Benus 2006), would make possible to model the relation between the phonological and phonetic variables within the same framework.

Appendix A: List of sentences used in the production part of the experiment

Abre el arMArio (He/she opens the closet – Open the closet), *aNIma a aMANda* (He/she cheers Amanda up – Cheer Amanda up), *GUARda el aNIllo* (He/she hides the ring – Hide the ring), *BArre la NAve* (He/she cleans the warehouse – Open the warehouse), *NAda en el LAgo* (He/she swims in the lake – Swim in the lake), *LAva al NIño* (He/she washes the kid – Wash the kid), *CIErra la MAno* (He/she closes his/her hand – Close your hand), *LLEva la LAna* (He/she carries the wool – Carry the wool), *HAbla en aleMAN* (He/she speaks in German – Speak in German), *VUElа a miLAN* (He/she flies to Milan – Fly to Milan) & *LEE la noVEla* (He/she reads the novel – Read the novel).

Appendix B: Example of the four contexts showed to the participants

1) Declarative: ¿Qué hace Pedro?: Abre el armario. *What is Peter doing?: He is opening the closet.*
2) Imperative (Imp1): Quieres que tu amigo abra el armario porque ha encerrado a tu hermano: ¡Abre el armario! *You want your friend to open the closet since he has locked your brother up: Open the closet!*
3) Repetition of the imperative - right after the imperative (Imp2): No te hace caso: ¡Abre el armario! *He does not pay attention to you: Open the closet!*
4) "Angry" imperative (Imp3): Has pedido a tu amigo 3 veces que abra el armario y no te hace caso. Le dices enfadado: ¡Abre el armario! *You have asked your friend three times to open the closet and he is ignoring you. You are angry and you tell him: Open the closet!*

Appendix C: Mean scores of imperative variables as correlates of imperativity

^{m} = male
^{f} = female

	jo^{m}	ia^{m}	mv^{m}	pm^{m}	jc^{m}	aj^{f}	bp^{f}	vp^{m}	hs^{f}	as^{m}	po^{m}	il^{f}	sc^{m}	Total
Downstep	2.3	3.1	2.6	1.8	3.5	3.6	3.5	3.4	2.4	3.5	3.5	2.5	3.2	3.03
F0 fall	2.3	4.1	4.6	2.6	4.4	4.2	3.9	4.0	4.2	3.1	4.3	2.5	4.8	3.82
Early Peak	1.7	3.1	1.8	2.0	3.7	3.5	1.6	2.7	2.5	3.5	3.3	2.5	3.4	2.75
H%	2.5	2.7	1.4	2.5	2.8	2.3	1.0	3.0	1.6	3.0	1.2	2.5	2.1	2.24
High F0	4.2	3.6	4.3	4.1	4.0	3.3	4.7	3.9	4.4	3.9	3.4	3.0	4.1	3.96
Maintenance	3.5	3.6	4.0	2.8	3.3	3.0	4.8	3.4	3.3	4.0	3.4	3.1	3.4	3.54
Upstep	4.1	4.5	4.4	3.6	2.5	2.4	3.1	3.2	4.3	3.6	3.8	3.9	3.0	3.62
All variables	4.9	4.5	4.5	4.5	1.5	2.0	1.0	4.9	3.5	3.5	2.5	3.5	1.5	3.27

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