THE PERCEPTION OF ITALIAN AND SPANISH LEXICAL STRESS: A FIRST CROSS-LINGUISTIC STUDY

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ABSTRACT

A preliminary experiment studying the perception of lexical stress in isolated Italian words by Spanish subjects has been carried out in order to find out possible cross-linguistic differences in closely related languages. The results show that there is a combined effect of native language expectations and acoustic information present in the signal.

Keywords: lexical stress, perception, Italian, Spanish.

1. INTRODUCTION

Experimental phonetics research has shown that languages use different strategies to signal the prominence associated to lexical stress by giving different acoustic and perceptual weights to three basic acoustic parameters: fundamental frequency (f_0), duration (D) and intensity (I).

Italian and Spanish share similar properties related to their accentual systems: they are both free stress languages, paroxytones are the most frequent category among polysyllabic words, CV is the most frequent syllabic pattern, they show a tendency to isosyllabicity, and a trend to f_0 peak displacement is apparent in both languages; moreover, cognates with the same stress pattern can be found. However the orthographic conventions for marking stress differ in the two languages and, above all, the acoustic manifestation of stress reveals certain differences: in internal word position, Italian stressed vowels are longer than Spanish ones, while in prepausal position, they are definitely shorter (see §2.2).

Finally, from the perceptual point of view, the strategies used to identify lexical stress, at least in isolated words, seem to be different in Spanish and Italian: perceptual tests carried out using the experimental procedure described in section 2 have revealed that duration, especially if combined with f_0, is the main cue that induces the identification of

a syllable as lexically stressed in Italian [1], while in Spanish [4] this is achieved by combining f_0 with changes in either duration or intensity. Although the effect of intensity has not been studied for Italian, the experiments put forward the fact that duration and f_0 play different roles as perceptual correlates of lexical stress in Spanish and Italian isolated words.

It has already been shown that speakers of a fixed stress language like French are "deaf" to contrastive accents in a free stress language such as Spanish [3, 5]; but, as far as we know, cross-linguistic experiments involving closely related languages such as Spanish and Italian have not yet been carried out systematically.

For this reason, a first experiment has been designed to assess the role of f_0 and duration in the perception of lexical stress in Italian words by native Spanish speakers.

Our initial hypothesis was that perceptual strategy closely depends on the native language: we expected that, listening to Italian stimuli, native Spanish subjects would have behaved quite differently from native Italian speakers. As we will see, against our expectations, they show a very particular behaviour, leading us to a complex analysis which needs to take into account a multiplicity of aspects. The data obtained might provide some insights into the interlanguage of Spanish learners of Italian and, at the same time, will offer the possibility of a further study of fine cross-language phonetic differences.

2. EXPERIMENTAL PROCEDURE

2.1. Corpus

In order to avoid any kind of possible linguistic interference between two so closely related languages, we have chosen Italian words that are not similar to Spanish words (i.e. we have not included couples like [re'gaːlo] '*I make a*

present' vs. [rega'lɔ] '*He/she made a present*' which exists in Spanish too with the same meaning).

As Table 1 shows, the corpus, read by a male native Italian speaker, consisted of six couples of meaningful three syllable words with CV structure and six couples of meaningless three syllable words with CV structure. Pseudo-words have an Italian phonetic realization quite different from the Spanish one, but a perfectly possible Spanish syllabic structure; the speaker did not receive particular instructions, he was asked to read following the indicated stress pattern.

Words	
['seːmino] [se'miːno]	[se'miːno] [semi'nɔ]
'I sow'-'little seed'	'little seed'-'He/she sowed'
['leːgami] [le'gaːmi]	[ro'viːno] [rovi'nɔ]
'Tie me up'-'ties'	'I ruin'-'He/she ruined'
['kaːpito] [ka'piːto]	[ka'piːto] [kapi'tɔ]
'I come'-'understood'	'understood'-'It happened'
Pseudo-words	
['naːvilo] [na'viːlo]	[na'viːlo] [navi'lɔ]
['maːligo] [ma'liːgo]	[ma'liːgo] [mali'gɔ]
['laːgano] [la'gaːno]	[la'gaːno] [laga'nɔ]

Table 1: Corpus

2.2. Method

The corpus was analyzed and synthesized using the Praat software [2], following the same experimental procedure adopted in [1, 4], which we can only summarize here; for each of the three vowels of the stimuli, we measured: a) f_0 at the beginning, at the centre and at the end of the vowel; b) vowel duration.

The acoustic analysis of the stimuli shows that in internal word position Italian stressed vowels are 35,8% longer than Spanish ones, but in oxytone words they are 12% shorter. Moreover, prepausal stressed vowels are, in Spanish, 42,3% longer than word internal ones, while in Italian they are 7,8% shorter than word internal ones.

The test stimuli were created in the following way: in proparoxytone words (PP), f_0 and duration values for each vowel were replaced by the corresponding f_0 and duration values found in the equivalent paroxytone words (P); in the same way, in P words, f_0 and duration values for each vowel were replaced by the corresponding f_0 and duration values found in the equivalent oxytone words (O).

Each word was resynthesised with the replaced values using PSOLA as implemented in Praat. The

values have been modified not only individually, but also simultaneously, obtaining the three possible combinations: f_0, D, f_0+D. This strategy has allowed the study of the effects of each acoustic cue both in isolation and in combination with the other.
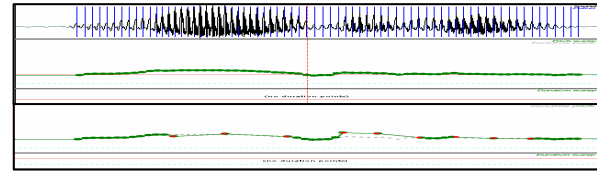

Figure 1: ['naːvilo] with the original f_0 contour (top) and after superimposing the f_0 contour of [na'viːlo] (bottom).

2.3. Subjects

Three groups of Spanish speakers were tested individually. The first group (group a) had been studying Italian for several months (5-9 months); the second one (group b) although had never studied Italian, knew some Italian thanks to travels to Italy, relationships with Italians or listening to Italian music; the third one (group c) had never studied Italian and had never had any kind of contact with this language. The thirty Spanish subjects, 4 boys and 26 girls, were students at the Universitat Autònoma of Barcelona aged 19 to 22 years.

2.4. Procedure

The tests were administered using a specifically designed data-collection software[1]. Subjects were told they were going to listen to Italian words and pseudo-words. The experiment consisted of two different tasks: identification of the stressed syllable (test 1) and discrimination of pairs of words differing in their stress pattern (test 2).

In test 1, we proposed 55 stimuli (19 original stimuli plus 12 x 3 items with manipulated values- D; f_0; D+f_0). In test 2, each modified word was proposed in couple with its original item and with its 'target' item. Moreover, each original word was proposed with itself in a balanced number with the modified items: for each couple of stimuli we have 12 items and for each triplet 21, obtaining a total of 129 couples of stimuli.

The stimuli were given in random order. A total of 5520 answers was obtained.

3. RESULTS

For original stimuli, the average of correct identification and discrimination reaches very high

values (94% and 99,9%), without relevant differences among the three groups and between words and pseudo-words. Results for words and pseudo-words stimuli with manipulations are summarised in Tables 2 and 3. For the sake of brevity, we will focus our attention on words, considering pseudo-words results as an aid to the global interpretation. Nevertheless, the differences in processing words and pseudo-words will be developed in future.

			PP	P	O
f_0	PP>P	a	**93,4** *(93,3)*	**3,3** *(6,7)*	**3,3** *(0)*
		b	**93,3** *(100)*	**0** *(0)*	**6,7** *(0)*
		c	**86,7** *(93,4)*	**10** *(3,3)*	**3,3** *(3,3)*
	P>O	a	**3,3** *(0)*	**63,4** *(76,6)*	**33,3** *(23,3)*
		b	**0** *(0)*	**70** *(86,7)*	**30** *(13,3)*
		c	**0** *(0)*	**56,7** *(80)*	**43,3** *(20)*
D	PP>P	a	**56,7** *(36,7)*	**43,3** *(50)*	**0** *(13,3)*
		b	**50** *(36,7)*	**50** *(63,3)*	**0** *(0)*
		c	**53,3** *(26,7)*	**46,7** *(66,7)*	**0** *(6,6)*
	P>O	a	**30** *(10)*	**66,7** *(60)*	**3,3** *(30)*
		b	**36,7** *(13,3)*	**43,3** *(80)*	**20** *(6,7)*
		c	**50** *(3,3)*	**40** *(70)*	**10** *(26,7)*
f_0+D	PP>P	a	**16,7** *(6,7)*	**80** *(93,3)*	**3,3** *(0)*
		b	**6,7** *(0)*	**90** *(96,7)*	**3,3** *(3,3)*
		c	**3,3** *(3,3)*	**93,4** *(90)*	**3,3** *(6,7)*
	P>O	a	**23,3** *(3,3)*	**20** *(36,7)*	**56,7** *(60)*
		b	**33,3** *(3,3)*	**16,7** *(43,3)*	**50** *(53,4)*
		c	**26,7** *(0)*	**10** *(46,7)*	**63,3** *(53,3)*

Table 2: Results in % from test 1 (identification) for words (bold) and pseudo-words (italics). (a, b, c = subject groups; X>Y = the original values of X were replaced by those of Y).

3.1. Manipulation of f_0

Analysing the results of f_0 manipulation in words, it can be seen that PP-stimuli with P-values are identified as paroxytone in percentages reaching the 10% of the cases, while P-words with O-values are perceived as oxytone in percentages ranging from 30 to 43,3% of the cases (see Table 2).

Comparing the results of the two tests, it can be observed that for both words and pseudo-words and for modified PP and P-stimuli, the manipulation of f_0 does not trigger a clear change in stress pattern perception. Even if it seems to be somehow more relevant for P-words with O-values, the discrimination test (see Table 3) does not confirm this hypothesis: the results show a clear trend in the case of PP>P, while answers are everything but coherent for P>O.

			PP / P		P / D	
f_0	PP>P		**PP**		**P**	
			S	D	S	D
		a	**86,7** *(66,7)*	**13,3** *(33,3)*	**0** *(6,7)*	**100** *(93,3)*
		b	**86,7** *(66,7)*	**13,3** *(33,3)*	**10** *(3,3)*	**90** *(96,7)*
		c	**90** *(80)*	**10** *(20)*	**3,3** *(0)*	**96,7** *(100)*
	P>O		**P**		**O**	
			S	D	S	D
		a	**60** *(83,3)*	**40** *(16,7)*	**33,3** *(16,2)*	**66,7** *(83,3)*
		b	**77,3** *(93,3)*	**26,7** *(6,7)*	**20** *(3,3)*	**80** *(96,7)*
		c	**46,7** *(76,7)*	**53,3** *(23,3)*	**20** *(3,3)*	**80** *(96,7)*
D	PP>P		**PP**		**P**	
			S	D	S	D
		a	**33,3** *(10)*	**66,7** *(90)*	**16,7** *(30)*	**83,3** *(70)*
		b	**16,7** *(10)*	**83,3** *(90)*	**46,7** *(36,7)*	**53,3** *(63,3)*
		c	**16,2** *(13,3)*	**83,3** *(86,7)*	**36,7** *(33,3)*	**63,3** *(66,7)*
	P>O		**P**		**O**	
			S	D	S	D
		a	**33,3** *(33,3)*	**66,7** *(66,7)*	**20** *(13,3)*	**80** *(86,7)*
		b	**36,7** *(30)*	**63,3** *(70)*	**6,7** *(6,7)*	**93,3** *(93,3)*
		c	**23,3** *(50)*	**76,7** *(50)*	**10** *(0)*	**90** *(100)*
f_0+D	PP>P		**PP**		**PP**	
			S	D	S	D
		a	**6,7** *(3,3)*	**93,3** *(96,7)*	**76,7** *(80)*	**23,3** *(20)*
		b	**0** *(3,3)*	**100** *(96,7)*	**80** *(60)*	**20** *(40)*
		c	**3,3** *(0)*	**96,7** *(100)*	**76,7** *(76,7)*	**23,3** *(23,3)*
	P>O		**P**		**O**	
			S	D	S	D
		a	**23,3** *(20)*	**76,7** *(80)*	**80** *(55,3)*	**20** *(46,7)*
		b	**23,3** *(26,7)*	**76,6** *(73,3)*	**36,7** *(33,3)*	**63,3** *(66,7)*
		c	**10** *(16,7)*	**90** *(83,3)*	**46,7** *(43,3)*	**53,3** *(56,7)*

Table 3: Results in % from test 2 (discrimination) for words (bold) and pseudo-words (italics).

3.2. Manipulation of duration

Looking at the answers concerning stimuli with modified duration in the identification test (see Table 2), it can be seen that subjects perceive stress location somehow differently from the previous case: they perceive a change in percentages that range from 43,3 (words) to 66,7% (pseudo-words).

In spite of all that, the trend found in modified P-words is somehow different: subjects do not perceive these stimuli as oxytone words, but they seem to have difficulties in identifying stress location, especially in words (even giving the answer PP).

This is strengthened by discrimination task answers: PP-stimuli with P-values are not perceived as the same as PP-words, but at the same time, they are clearly discriminated as different from P-words; P-stimuli with O-values are strongly perceived as different from P-words, but are even clearly discriminated as different from O-words (see Table 3).

It seems rather clear that when only duration is manipulated, subject's answers are far less

coherent than those obtained with stimuli involving other types of changes.

3.3. Manipulation of f_0 and duration

Confirming the idea that acoustic parameters act in combination, when f_0 and duration values are simultaneously modified, subjects perceive a change in stress location in a high percentage of cases, both in words and pseudo-words.

It is quite interesting to notice that the manipulation has a stronger effect on the original PP-words in comparison with the original P ones. Discrimination test (see Table 3) shows quite clear and coherent answers, above all for PP-stimuli with P-values.

4. DISCUSSION

Experiments with native language stimuli revealed that Spanish subjects were sensitive to changes in f_0 [4], while Italian ones were not clearly influenced by this manipulation [1]. On the other hand, Spanish subjects did not perceive changes in stress location in the case of manipulation of D, while Italian listeners were aware of duration differences in Italian stimuli.

Listening to Italian stimuli, it is evident that Spanish subjects tend to have a more similar behaviour to Italian subjects listening to Italian words than Spanish subjects exposed to Spanish items: they do not perceive the manipulation of f_0 in PP-words with P-values, but they seem quite sensitive to manipulation of D. In the case of P-words with O-values, answers are less coherent: f_0 role seems to be less clear; but more and more serious difficulties appear in the case of Italian words and pseudo-words with D manipulation.

Differences of acoustic duration between Spanish and Italian stressed vowels (see §2.2) could be considered one of the reasons of this behaviour, especially with oxytone words: Spanish subjects are somehow unable to solve a sort of conflict between the acoustic stimuli -short final stressed vowels- and their L1 expectations -long final stressed vowels-.

However, problems with oxytones have been also detected in native language perception. Since stress perception also depends on the stress pattern, it is possible that duration is more relevant in proparoxytone words than in oxytone ones. This would agree with the results reported in [4] concerning the different role of each perceptual cue in PP>P and P>O manipulations, and would also suggest that intensity should be taken into account, especially in oxytone words.

On the other hand, it is possible that the higher frequency of paroxytone words in Spanish and Italian may bias the processing of oxytone words towards the more common pattern.

We have tested the experiment on three different groups of subjects in order to point out possible differences depending on the degree of Italian knowledge. The analysis of each group does not reveal a clear trend and needs a deeper investigation, but some results may suggest that, in certain cases, group a would tend to rely on lexical knowledge, while group c would make a more intensive use of acoustic information: comparing pseudo-words with words results, it can be seen that in the first case the three groups have a more similar behaviour than in the second one.

5. CONCLUSIONS

The results of our preliminary experiment with non-native subjects and the comparison with previous research with native speakers show that, in spite of several similarities between Spanish and Italian, there are relevant differences in the way stress is perceived. The performance of non-native subjects appears to be influenced by their native language but, at the same time, by the acoustic features of the signal; this leads, in certain cases, to lack of coherence in the stress judgements which can be related to conflicting cues.

Further research using Spanish stimuli with Italian subjects will help to clarify some of the issues raised in this first approach.

6. REFERENCES

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