

Syllable Weight and the Perception of Spanish Stress Placement by Second Language Learners

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Abstract

While the role of syllable weight in the Spanish accentual system has been a topic of considerable theoretical debate over the years, recent experimental studies of different types have shown that syllable weight is a factor in the determination of stress placement in Spanish. One such study shows that native Spanish speakers take syllable weight into account as they perceive the location of stress within a word. The present study investigates whether or not second language learners at three different levels of Spanish instruction also make use of syllable weight information in their perception of stress placement. The results show that as students advance in their study of Spanish, they make more use of syllable weight as a cue to Spanish stress placement, though they seem to first perceive a default penultimate stress pattern regardless of syllable weight. While learners do increasingly make use of syllable weight in perceiving Spanish stress placement, this is primarily limited to the largest syllable weight generalization about stress in the language, and learners do not make use of more intricate effects of syllable weight in their perception of stress placement in the way that native speakers do. Additionally, as learners' ability to make use of syllable weight information in perceiving stress placement increases, they also improve in their accuracy of perceiving the acoustic cues to Spanish stress.

1. Introduction

In studying the nature of Spanish stress, phoneticians have focused on the acoustic correlates of stress: pitch, duration, and intensity (Enríquez, Casado, and Santos 1989; Face 1999; Llisterri, Marín, de la Mota, and Ríos 1995; Quilis 1971, 1993 among many others). The most recent studies (see especially Enríquez, Casado, and Santos 1989) indicate that the primary acoustic correlate is pitch, with duration also playing an important role, and intensity, which at one time

was believed to be the key factor, playing a very small role if any at all.¹ The acoustic correlates of stress are only one aspect of a larger picture, however.

In addressing Spanish stress, Quilis (1971) states that "the sensation of a physical stimulus is channeled through the structures of a language" (translation mine). This notion of the relationship between a physical stimulus and language structure has recently been a growing area of research in linguistics, and the papers in Hume and Johnson (2001b) examine specifically the role of perception in phonology. In their lead paper of that volume, Hume and Johnson (2001a) pose four research questions, one of them being "To what extent does the phonological structure of language influence speech perception?" Work by Face (2000) has begun to investigate this issue and has shown that syllable weight plays an important role in the perception of Spanish stress placement by native speakers. In addition, while not perception studies, experimental studies by Eddington (2004) and Waltermire (2004) also show that syllable weight is a factor in Spanish stress placement.

Studies on the acquisition of Spanish stress, though much more infrequent than studies based on adult native speakers, have looked primarily at the production of stress to the exclusion of perception (Bullock and Lord 2003; Hochberg 1988; Morales-Front, Barker and Cruz 1999). Lord (2001, 2004) does investigate the perception of Spanish stress by native English-speaking learners of Spanish, investigating the accuracy of the perception of stress placement. Her findings show that position of stress within the word does not influence accuracy of the perception of stress placement. Additionally, Lord's results show that learners progress in accuracy of perceiving stress placement as their experience with Spanish increases, but that even beginners are quite accurate. This perceptual accuracy is much greater than learners' accuracy in producing stress in the correct place (Bullock and Lord 2003). While Lord's work makes an important and unique contribution to studies on the second language acquisition of Spanish stress (and phonology in general), the present study takes another look at the issue of the perception of Spanish stress placement by second language learners by considering whether they make use of syllable weight information in the way that Face (2000) reports for native speakers of Spanish. It will be shown that syllable weight plays a role in a learner's ability to perceive Spanish stress,

¹ See Prieto and van Santen (1996) for a discussion of the importance of intensity as a cue for secondary stress.

and that as learners improve in their ability to make use of this cue, their ability to correctly perceive the acoustic correlates of stress (i.e., pitch, duration, and intensity) improves as well.

The remainder of this paper is organized as follows: In the following section the results of Face (2000) for native speakers of Spanish is summarized. Section 3 explains the methodology used in the present study. Section 4 presents the results of the experiment used to test the role of syllable weight in the perception of Spanish stress by American students. Lastly, Section 5 discusses the findings of the present study and their implications for future work on second language acquisition.

2. Summary of Face (2000)

Face (2000) shows that syllable weight plays an important role in the perception of stress by native speakers of Spanish. This was accomplished through the use bisyllabic and trisyllabic nonce words synthesized so that no syllable was more acoustically prominent than the other syllables in the word, and therefore no syllable could be interpreted as acoustically stressed. Despite the lack of acoustic prominence, speakers showed a high rate of agreement as to which syllable was stressed, and this agreement is shown to correspond to the weight of the syllables which make up the word. In Spanish unmarked stress is determined by the final segment of the word. When the final segment is a vowel (i.e., the final syllable is light), unmarked stress falls on the penultimate syllable and when the final segment is a consonant (i.e., the final syllable is heavy), unmarked stress falls on the final syllable.² Face (2000) shows that speakers make use of this knowledge in perceiving stress, as there was a strong tendency to perceive unmarked stress in the neutrally pronounced words (i.e., words without an acoustically prominent syllable), as can be seen in Table 1.

² Words ending in *-s* and *-n* regularly have a stressed penultimate syllable due to verbal morphology. In this study there are no words ending in *-s*, though this is to another constraint on my stimuli that no syllable end in *-s*. Since some dialects aspirate or delete a final *-s*, its presence could make the syllable sound particularly prominent, and therefore stressed, to subjects from these dialects. In words in the present study that end in *-n*, the preceding vowel is *o* or *u*, thus avoiding the terminal sequences *-an*, and *-en* which are associated with penultimate stress in verb forms (see Hochberg 1988).

Weight of Final Syllable	Perceived Unmarked Stress	%
Heavy	204 of 300	68
Light	241 of 300	80.3
All	445 of 600	74.2

Table 1: *Perceived unmarked stress in neutral pronunciations (Face 2000)*

Words were also included in the experiment which did have an acoustically prominent (i.e., stressed) syllable. Face (2000) shows that in these words stress is correctly perceived in 99.5% of the cases where the acoustically prominent syllable corresponds with unmarked stress, but only in 82% of the cases where the acoustically prominent syllable does not correspond with unmarked stress. What is most telling, however, is that in the errors made in these cases, nearly two-thirds of the errors "corrected" the location of the stress, with the listener perceiving unmarked stress based on syllable weight rather than perceiving the acoustically prominent syllable as stressed.

Face (2000) also shows that syllable weight plays a role in stress perception beyond its role in determining unmarked stress. His results show that the rightmost heavy syllable in a word attracts perceived stress. When the final syllable is light, unmarked penultimate stress is generally perceived, but this tendency is even stronger when the penultimate syllable is heavy. In addition, when the penultimate syllable is also light, a heavy antepenultimate syllable will attract stress away from the penultimate syllable more often than will a light antepenultimate syllable. Any heavy syllable that is not the rightmost heavy syllable in the word does not attract perceived stress in this way.

The results found by Face (2000) provide evidence that Spanish syllable weight, a highly-debated topic in Spanish phonological theory, plays a role in the Spanish accentual system. This finding has been supported by other types of experimental studies as well (Eddington 2004, Waltermire 2004).

3. Methodology

In order to test whether American students learning Spanish are able to make use of syllable weight in the perception of stress placement, or whether it is a characteristic only of native

competence, Face's (2000) experiment was duplicated with American students studying three different levels of Spanish. The 30 subjects were all students taking Spanish classes at The Ohio State University. Of the 30 subjects, 10 had completed the elementary language sequence, 10 had completed the intermediate language sequence, and 10 were advanced students who had completed the requirements for a major in Spanish.

The experiment used in the present study is identical to that used in Face (2000). Each of the 12 possible combinations of heavy and light syllables for bisyllabic and trisyllabic words was instantiated in five nonce words (60 total). In these words all of the syllables were neutral with regard to stress. That is, the acoustic correlates of stress had equal values in all of the syllables, as explained in more detail below. The guidelines used by Hochberg (1988) in creating nonce words to avoid sequences of segments strongly associated with particular stress patterns were followed.

The words were produced by the MBROLI speech synthesizer (Dutoit et al. 1996) so that the pitch and duration of all the vowels could be controlled.³ In order to test the effects of the phonological structure of the word rather than the ability of the listeners to perceive different acoustic cues, all words were neutral with regard to stress, with all vowels being equal in pitch and duration. The specific values were based on those used by Enríquez, Casado, and Santos (1989). They set their values for unstressed vowels at 100Hz and 60ms, and their values for stressed vowels at 116Hz and 120ms. The 100Hz value was adopted for this experiment, but due to the extreme speed of speech with all vowels being 60ms in duration, the average of their duration values for unstressed and stressed vowels was used, making all vowels in the neutrally pronounced forms 90ms long.

The stimuli included 40 additional nonce words in which the acoustic correlates of stress were manipulated to produce a stressed syllable. In these words the exact values used by Enríquez,

³ Although recent studies indicate that intensity plays little role in Spanish stress, there must be some control so that the absence of other factors would not cause increased intensity levels to be perceived as stress. While the MBROLI synthesizer does not allow for intensity control, acoustic analysis indicated that the intensity peaks of all vowels within a word were identical, though there seemed to be slight variation of the exact measurement from word to word. All intensity values were in the vicinity of 70 dB.

Casado, and Santos, 100Hz and 60ms for unstressed vowels and 116Hz and 120ms for stressed vowels, were adopted. These forms contained a variety of stress patterns, both unmarked and marked. After synthesis, the completed set of nonce words to be used in the experiment was reviewed by a native speaker of Spanish, and words which were similar to actual Spanish words were replaced in order to avoid association of the nonce word to a real word whereby the stress pattern of the real word might be imposed on the nonce word.

The 100 stimuli (see appendix) were presented over headphones in random order to each listener. After the presentation of a bisyllabic word, the numbers 1 and 2 appeared on a computer screen, and after the presentation of a trisyllabic word, the numbers 1, 2, and 3 appeared. The listeners then used the mouse to choose the number corresponding to the syllable they perceived as stressed.

4. Results of the Experiment

Students studying Spanish are generally instructed to determine which syllable of a word is stressed based on its orthography. Orthography, however, is not accessible to a hearer. When students hear a word, especially if it is a word that they do not know, there is no way to make use of its orthography as a key to determining which syllable is stressed. I begin looking at the three groups of students in order to see whether they perceive stress based on the unmarked stress patterns of Spanish, which are determined by the weight of the final syllable, as described above.

When there was no acoustic stress, the only means available to the students from the nonce word itself from which to perceive a particular syllable as stressed was the weight of each syllable in the nonce word. The data in Table 2 show that there is a consistent increase in the perception of the unmarked stress patterns in the nonce words as the students' level of instruction increases.

Final Syllable	Elementary		Intermediate		Advanced	
	Perceived Unmarked Stress	%	Perceived Unmarked Stress	%	Perceived Unmarked Stress	%
Heavy	84 of 300	28	103 of 300	34	122 of 300	41
Light	149 of 300	50	165 of 300	55	223 of 300	74
All	233 of 600	39	268 of 600	45	345 of 600	58

Table 2: *Perception of unmarked stress pattern*

While perception of the unmarked stress pattern increases both for words with heavy final syllables and words with light final syllables as the students' level of instruction increases, the unmarked pattern is always perceived much more often in words with light final syllables. While not to the same extreme, Face (2000) finds a similar pattern among native speakers of Spanish (cf. Table 1). His claim is that while final stress can be unmarked based on syllable weight, penultimate stress is truly a default stress pattern. With regard to the data in Table 2, it can be said that students learning Spanish are more sensitive to the default stress pattern than they are to unmarked stress patterns based on syllable weight.

A statistical approach to the data in Table 2 shows neatly the advancement of the perception of unmarked stress. Face (2000) reports that the weight of the final syllable is a statistically significant factor in determining a hearer's perception of final stress and penultimate stress. T-tests applied to the data in Table 2 show that the weight of the final syllable is not significant in determining the perception of either the final or the penultimate syllable as stressed for the group of elementary students. For the intermediate students, the weight of the final syllable is statistically significant ($p < 0.01$) in the perception of final stress, but not of penultimate stress. And for the advanced students, the weight of the final syllable is statistically significant in the perception of both final and penultimate stress. This shows a clear progression in the use of the weight of the final syllable of a word as a cue to which syllable is stressed. In addition, the results for the intermediate students support the claim that the default stress pattern is learned prior to the phonologically unmarked stress patterns. Since the weight of the final syllable is only statistically significant in determining its own perception as stressed, but not in determining the perception of the penultimate syllable as stressed, it must be the default stress pattern, rather than the phonologically unmarked stress pattern, which causes these students to perceive penultimate stress. Since phonologically unmarked penultimate stress relies on a light final syllable, and

these students do not use the weight of the final syllable as a cue to perceiving penultimate stress, the only possible explanation is that they are making use of the default stress pattern.

Face (2000) reports that native speakers use syllable weight in ways which go beyond its use for determining unmarked stress. Since penultimate stress is unmarked when the final syllable is light, the weight of the penultimate syllable is not a significant factor in its own perception as stressed or unstressed. This holds true for the present study as well, as the weight of the penultimate syllable is not a significant factor for any of the three groups of students in its perception as stressed. In Face's (2000) study, however, for trisyllabic words with a light final syllable, the weight of the penultimate syllable is a determining factor in the ability of the antepenultimate syllable to be perceived as stressed. His results are shown in Table 3.

Weight of Penultimate Syllable	Perceived Stress		
	Antepenultimate	Penultimate	Final
Heavy	3	86	11
Light	18	66	16

Table 3: *Stress perception in words with light final syllables (Face 2000)*

These results show that a heavy penultimate syllable all but impedes the perception of the antepenultimate syllable as stressed, while a light penultimate syllable allows the antepenultimate syllable to be perceived as stressed. A t-test shows that the weight of the penultimate syllable is a statistically significant factor in the perception of the antepenultimate syllable as stressed. The data for the present study are shown in Table 4.

Weight of Penultimate Syllable	Elementary			Intermediate			Advanced		
	A	P	F	A	P	F	A	P	F
Heavy	30	46	24	33	52	15	20	74	6
Light	40	36	24	47	35	18	37	58	5

Key: A=antepenultimate, P=penultimate, F=final

Table 4: *Stress perception in words with light final syllables*

These data show that students perceive the antepenultimate syllable as stressed more often when the penultimate syllable is light than when it is heavy. However, t-tests reveal that the weight of the penultimate syllable is a statistically significant factor in the perception of the antepenultimate syllable as stressed only for the advanced students. Regardless of the weight of

the penultimate syllable, there is a much higher rate of perception of the antepenultimate syllable as stressed for all three groups of students than Face (2000) found for native speakers (cf. Table 3). In Spanish a stressed antepenultimate syllable is always a marked stress pattern, which explains its low rate of being perceived as stressed by native speakers when there is no acoustic stress present. The native speakers generally perceive stress according to unmarked stress patterns. This same tendency is not as strong for students learning Spanish, not even the most advanced students, and is likely related to a tendency for antepenultimate stress in English. While descriptions of English stress placement are very complicated, generally based on morphology, and do not mention a particular default pattern, the data in Table 4 may provide evidence of an antepenultimate default for English stress, or at least of the influence of the English tendency for stress early in a word. The influence of the native language on the perception of a foreign language comes as no surprise, as that is the only linguistic system which the hearer knows. While a separate system may be in development, it is certainly not as strong as the native system and the native system may be used to fill in gaps in the developing second language system.

Lastly, Face (2000) shows that when both the final and the penultimate syllables are light, the weight of the antepenultimate syllable is a statistically significant factor in its perception as stressed, with a heavy antepenultimate syllable attracting perceived stress and a light antepenultimate syllable generally not being perceived as stressed. This pattern is not found for any of the groups of students in the present study, as the weight of the antepenultimate syllable is never a statistically significant factor in its perception as stressed.

The forty nonce words included in the experiment which did contain an acoustically stressed syllable also provide interesting data. Face (2000) showed that native speakers of Spanish correctly perceived stress placement 89% of the time. I observed the ability of the students included in the present study to correctly perceive stress placement in those words containing an acoustically stressed syllable. The results are shown in Table 5.

Level	Perceived Acoustic Stress	%
Elementary	256 of 400	64
Intermediate	296 of 400	74
Advanced	336 of 400	86

Table 5: *Correct perception of acoustic stress*

These data show a clear improvement in the ability to correctly perceive the acoustic correlates of stress as the students' level of instruction increases. The advanced group perceives stress correctly nearly as often as native speakers, as Lord (2004) also finds. Face (2000) also reports that in nearly two-thirds of the errors made by native speakers, the error is in the direction of regularizing stress. The data in Table 6 show that as students reach a higher level of instruction, a higher percentage of their errors are in the direction of regularizing stress.

Level	Errors Regularizing Stress	%
Elementary	48 of 144	33
Intermediate	43 of 104	41
Advanced	35 of 64	55

Table 6: *Errors regularizing stress*

In combination with the data in Table 5, this steady increase in errors in the direction of unmarked stress shows that students are not only improving in their ability to correctly perceive stress, but also in their understanding of the accentual system of Spanish.

5. Discussion and conclusions

I have shown that as students progress in their level of instruction in the Spanish language they begin to perceive stress more and more according to the unmarked stress patterns of the language. There is always a much higher rate of perceiving penultimate stress when it is unmarked than final stress when it is the unmarked pattern. A similar pattern was shown by Face (2000) for native speakers of Spanish, and he claimed that this is because penultimate stress is truly a default stress pattern regardless of the syllable weight factors that determine phonologically unmarked stress. The occurrence of this pattern among students of Spanish, and especially to the degree it is seen in the present study, shows that students first acquire the default stress pattern, and later acquire the phonologically unmarked stress patterns.

In the present study it was seen that students learning Spanish do not use syllable weight beyond its use for determining unmarked stress nearly as much as do native speakers. Rather they make use of only the largest generalization that can be made about syllable weight and stress placement. While I have shown that there is some indication that the weight of the penultimate syllable plays a role in the perception of the antepenultimate syllable as stressed, it was also pointed out that, regardless of syllable weight issues, the antepenultimate syllable is perceived as stressed far more often than is the case for native speakers. I claim that this is due to the preference in English for stress to occur early in the word.

Lastly, I have shown that students learning Spanish consistently improve their ability to correctly perceive acoustic stress. This seems to indicate a certain degree of relationship between the acquisition of the ability to perceive stress and the acquisition of the phonological system which determines unmarked stress since both of these show steady improvement as a student reaches higher levels of instruction in Spanish. At this point it is unclear whether one of these perceptual abilities aids the other, and this remains a topic for future research.

About the Author

Timothy L. Face researches at the University of Minnesota, USA. His research interests lie in the fields of Spanish phonology, second language phonology, laboratory phonology, phonetics, phonological theory.

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APPENDIX

List of nonce words used in the perception experiment:

Neutrally pronounced words by structure (H=heavy syllable, L=light syllable):

<u>HH</u>	<u>HL</u>	<u>LL</u>	<u>LH</u>
bansil	benca	desa	nijad
fontal	fumpa	lula	paton
pensor	nonca	noca	posal
reldon	pirta	paba	tagul
tertur	terpa	tana	tifor
<u>HHH</u>	<u>HHL</u>	<u>HLH</u>	<u>HLL</u>
combaltur	birsanca	bordanor	fandula
landanson	dintalda	dortipor	calseba
linlenton	fandolta	fundamil	polcada
mentertad	pontumba	contabal	tortina
jurlandil	jornenca	salmedad	jansoda
<u>LHH</u>	<u>LHL</u>	<u>LLH</u>	<u>LLL</u>
dafantul	fulanga	cabadon	fadola
fafurnal	paterba	masapur	galefa
padorsel	sobenda	soserol	mabina
silangon	tacamba	sufapad	piluca
torencor	torilca	tajonil	tiroga

Words containing an acoustically stressed syllable (all stressed vowels marked):

borbána	corpulín	parpón	samfínga
dámpor	lása	pertantúl	saróca
filór	labúron	potorná	sasúnta
fadatór	lariná	púrpona	solpá
fagúlnor	lempegá	quetá	súbal
falbá	mérta	quindél	tacól
fampelón	matéba	quisondál	tandagál
fandél	medín	réla	tansálcon
catosín	mompertá	salsóta	tésora
compésil	musá	saltúnor	túnga