Acquisition Data and Phonological Theory: The Case of Spanish Stress
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ACQUISITION DATA AND PHONOLOGICAL THEORY: THE CASE OF SPANISH STRESS

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The goal of this paper is to use data from an experiment in language acquisition to evaluate three theories of Spanish stress.[1] I hope to show that acquisition data can be of use, not only in judging between theories, but in pointing out new directions for future theorizing to take.

The paper is organized as follows. I will first outline some basic facts of Spanish stress, describe the similarities and differences between three theories proposed to account for them, and discuss why one might want to use language acquisition data to help choose among them. Next, I will show how my experimental data favor one theory -- Harris' metrical account -- over the other two. Finally, I will discuss how some additional aspects of the acquisition data highlight facts of Spanish that are unaccounted for under any current analysis.

Spanish Stress

[2]

Stress on Spanish non-verbs is neither rigidly phonologically conditioned, nor entirely free. Stress can be found on any of the last three syllables of a word, regardless of the final segment of the word, as shown in Table 1.

Table 1
Possible stress placements in Spanish

stress	vowel-final words	consonant-final words
final	mamá 'Mommy'	tenedór 'fork'
penultimate	cuchára 'spoon'	azúcar 'sugar'
ante-penultimate	teléfono 'telephone'	hipótesis 'hypothesis'

Of these six possible placements, two are dominant in frequency: final stress on consonant-final words, and penultimate stress on vowel-final words. These two types account for around 90% of Spanish non-verb tokens, at least in written text (Hooper & Terrell 1976: 67).

Theories of Spanish stress

The three theories to be considered here are Whitley's Distinctive Stress Approach (1976), Hooper and Terrell's natural generative phonology analysis (1976), and Harris' metrical analysis (1983). I will first describe their main stress rules, and how they handle exceptions to these rules, and then describe which stress patterns they each prohibit.

Whitley's main stress rule stresses the penultimate syllable of a word, thus yielding correct stress on words like cuchára and azúcar. All other words must have a [+stress] diacritic on their stressed syllable to avoid receiving penultimate stress. In many cases, the [+stress] marking is underlying. However, redundancy rules supply [+stress] on certain large classes of exceptions: final-stressed consonant-final words formed with derivational suffixes (e.g., libertád 'liberty', solár 'solar'), and antepenultimate-stressed, vowel-final words formed with the suffixes -ico/a and -ulo/a (e.g. química 'chemistry', círculo 'circle') or with Greco-Latin formatives such as -logo and -metro (e.g., prólogo 'prologue', kilómetro 'kilometer').

Hooper and Terrell's main stress rule assigns stress to the final syllable of the stem. For most vowel-final words, the final vowel is outside the stem, as shown by its loss in derivation (e.g., cuchára 'spoon', cucharíta 'little spoon'). Thus the rule yields the two dominant stress categories of penultimate stress on vowel-final words and final stress on consonant-final words, as shown in (1) and (2) (where ']' indicates the rightmost stem boundary):

1) cuchár]a
2) tenedór]

For final-stressed, vowel-final words like mamá, Hooper and Terrell make use of the observation that the final vowel is part of the stem, as shown by its retention in derivation: cf. mamá v. the diminutive mamacíta. Application of the stem-final stress rule thus yields final stress on words of this type, as in (3):

3) mamá]

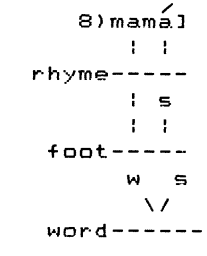
Finally, for words like azúcar and teléfono, a lexical diacritic 'X' on the stem-final syllable shifts stress one syllable leftward:

4) azúcar]
X

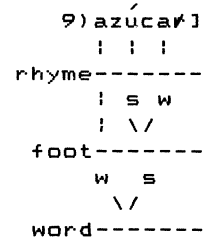
5) teléfon]o
X

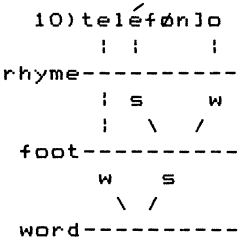
Harris' main stress rule has two parts: a foot formation rule which builds left-dominant, quantity-sensitive binary feet from right to left, and a tree-formation rule which builds a right-dominant word tree. Like Hooper and Terrell's main stress rule, this yields the two dominant categories of penultimate stress on vowel-final words and (because of quantity sensitivity) final stress on consonant-final words:

Again like Hooper and Terrell, Harris' treatment of mamá-type words depends on the fact that the final vowel is inside the derivational stem. His Strong Foot Rule stipulates that such a vowel be labeled strong, yielding derivations such as (8):



Finally, and again like Hooper and Terrell, Harris uses lexical marking to assign stress to azúcar and teléfono types. The lexical marking he uses is extrametricality, which causes stress to be 'blind' to a particular segment, as in (9) and (10) (where a slash indicates an extrametrical segment):





Thus far we have seen that the three theories differ in what their main stress rules generate as regular, versus what must be marked as exceptional or irregular. In Whitley's treatment, penultimate stress is always regular, and non-penultimate stress always exceptional. In the other two, regularity depends on the final segment of the word: penultimate stress is regular for vowel-final words, and final stress for consonant-final words.

The theories differ further in which stress types are excluded altogether. Whitley's account includes a rule which explicitly limits stress to the last three syllables of a word, thus forbidding words such as the hypothetical *cátapana. Such words are also exluded under Hooper and Terrell's theory, since the X diacritic moves stress only as far back as the penultimate syllable of the stem:

11)*cátapanla
X

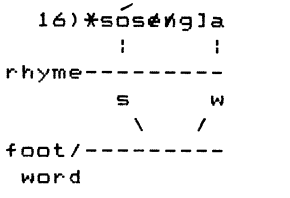
For the same reason, this theory (unlike Whitley's) also prohibits antepenultimate stress on consonant-final words where the final consonant is inside the derivational stem; compare the hypothetical and forbidden (12) with the permitted (13):

12)*pánaquil]
X

13)hipóteslis (-is is stem-external; cf. hipotético)
X

Harris' model likewise excludes *cátapana and *pánaquil types, by virtue of the proposed universal Peripherality Condition: that extrametrical segments must be peripheral in (i.e., at the edge of) their domains. In the case of Spanish, this means that only a stem- or word-final rhyme segment can be extrametrical. *Cátapana or *pánaquil would require two extrametrical segments within the stem, thus violating this condition:

The Peripherality Condition also prohibits a third stress type: antepenultimate stress on words with a branching rhyme in the penult. Again, two extrametrical segments would be needed, as in (16):



Thus all three theories prohibit cátapana types, all but Whitley's prohibit pánaquil types, and only Harris' prohibits sósenga types.

Motivation for the study

On descriptive grounds alone, Harris' theory seems superior to the other two. Along with Hooper & Terrell's account, it holds the most frequent stress patterns to be regular (penultimate for V# words, final for C# words). In addition, it accounts for more prohibited stress types than do the other two theories.

The purpose of gathering psycholinguistic data, whether from children or from adults, is to ensure that this superiority can be attributed to the speaker as well as to the linguist. To take an extreme view, it may be that the relative freedom of stress placement in Spanish leads speakers not to formulate any stress rules at all. Barring this unlikely but nevertheless possible scenario, speakers of Spanish might, for example, consider sósenga types to be no more irregular than bóchaca types, or (as in Whitley's analysis) associate final stress on consonant-final words with specific suffixes. Given the benefit of psycholinguistic data, there is a simple reason why child data on Spanish stress are preferable to adult data: stress is marked in Spanish orthography, and studying pre-literate children avoids the difficulty of eliciting knowledge of phonological as opposed to orthographic rules.

The experiment

In order to access children's knowledge of Spanish stress rules, I had fifty 3-, 4-, and 5-year-old Spanish-speaking children imitate novel Spanish words minimally contrasting in stress placement, the assumption being that regular stress patterns should be easier to imitate. The stimuli consisted of 35 sets of 2, 3, or 4 novel words that were segmentally identical but contrasted in stress placement. These 35 sets were further divided into seven groups of five sets each, based on their length and syllable structure. As shown in Table 2, four of these groups tested regular/irregular contrasts on two- and three-syllable consonant- and vowel-final words. The remaining three contrasted the three possible prohibited stress types (cátapana, pánaguil, and sósenga) with segmentally identical words with regular or irregular stress.

Table 2
Stimulus groups for the imitation experiment

1) 5 CVCV pairs
   e.g., gága, gagá

2) 5 CVCVCV triplets
   e.g., bóchaca, bocháca, bochacá

3) 5 CVCVC pairs
   e.g., guífor, guifór

4) 5 CVCVCVC pairs
   e.g., cabádon, cabadón

5) 5 CVCVCVCV quadruplets
   e.g., cátapana, catápana, catapána, catapaná

6) 5 CVCVCCV triplets
   e.g., sósenga, sosénga, sosengá

7) 5 CVCVCVC triplets
   e.g., pánaguil, panáguil, panaguíl

These novel words were presented in random order, and the children were asked to imitate them. The ease of imitation for each type (e.g., CVCV) was measured according to the number of structure-changing errors made. This included deletion or addition or segments or syllables, stress shift, or metathesis: any error that did more than alter an individual segment.

Evaluating the theories

The results of the experiment, as shown in Table 3, support Harris' theory over the other two.3 Let us first consider the regular/irregular contrasts. Recall that Whitley's main stress rule yields penultimate stress on all words as the regular case, whereas Hooper & Terrell's and Harris' yield penultimate stress on V# words, and final stress on C# words. The data show that as the latter two theories would predict, on vowel-final words children had the least difficulty with penultimate-stress, while for consonant-final words, final stress was easiest. In addition, whereas Whitley's use of redundancy rules implies that the difficulty of imitating guifór and bochaca types should vary with the phonetic characteristics of individual words, there were no word effects in the data. Thus Whitley's account, as opposed to Hooper & Terrell's and Harris', fails to account for the data so far.

Table 3
Percent error on imitations

type (example)	stress				N
	´6666#	´666#	´66#	´6#	
CVCV (gaga)	----	----	7	23	115
CVCVCV (bochaca)	----	20	13	32	245
CVCVCCV (sosenga)	----	77	42	75	250
CVCVCVCV (catapana)	56	33	14	54	130
CVCVC (guifor)	----	----	37	18	115
CVCVCVC (cabadon)	----	----	52	22	245
CVCVCVC (panaquil)	----	34	48	20	250

The data regarding the possible prohibited types cátapana, pánaquil, and sósenga allow us to further distinguish between Hooper & Terrell's and Harris' accounts. Recall that the former prohibits only cátapana and pánaquil types, while the latter prohibits all three. In fact, children found all three harder to imitate than comparable irregulars. They made more errors on cátapana types than on catápana types (though not more than on catapaná types, a point I shall return

to below). And they made more errors on both pánaguil (closed final) and sósenga (closed penult) types than on bóchaca (open final and penult) types.4 Thus Harris' theory, unlike Hooper and Terrell's, makes accurate predictions for prohibited-type words, as well as for regulars versus irregulars.

Further facts for future theorizing

The distinctions between regular, irregular, and prohibited stress account for most, but not all, of the error patterns in the children's data. The most dramatic additional fact to emerge from the data is the unexpected difficulty that children encountered in imitating long, vowel-final words with final stress. Final-stressed bochacá and catapaná types were harder to imitate than the corresponding irregular, antepenultimate-stressed bóchaca and catápana types. And sosengá and catapaná types were just as hard to imitate as the corresponding prohibited sósenga and cátapana types.

The difficulty posed by long final-stressed V# words is especially striking when contrasted with the relative ease of imitation of long penultimate-stressed V# types. While children made more errors on catapaná types than on bochacá types, and more on bochacá types than on gagá types, their scores on catapána, bocháca, and gágá types were statistically indistinguishable.

This distinction is particularly interesting because it jibes with a hitherto unnoticed fact of Spanish: long V# types are few and obscure. Whitley, in his extensive list of V# words, gives only six that are four syllables long. Of these, only one is common: israelí 'Israeli'. Of the remaining examples, one is borrowed and the others obscure: Misisipí, arracachá 'kind of plant', caracará 'native American hawk-like bird', maravedí 'old Spanish coin', and zalamelé 'flattery' (Whitley 1976: 318). At the other end of the scale, two-syllable V# words are both numerous and commonly used: they include aquí and acá 'here', allí and allá 'there', bebé 'baby', café 'coffee', champú 'shampoo', mamá 'Mommy', papá 'Daddy', menú 'menu', Perú, and rubí 'ruby'.

Two difficulties arise when considering how this observation might be incorporated into future theoretical accounts of Spanish stress. The first is aesthetic. Ideally, one would like to tie together Spanish speakers' avoidance of long sequences of unstressed syllables at either the beginning or the end of a word (i.e., catapaná or cátapana types). However, under current theorizing the two types are unrelated. The badness of the first must be expressed as a restriction

on the possible length of vowel-final stems, while that of the latter falls out as a consequence of the Peripherality Condition.

The second difficulty is more general: there is simply no provision made in any current model for expressing degrees of irregularity. At least for children, categorizing types such as bóchaca and bochacá or gagá and catapaná together as 'irregular' fails to capture the significant difference in speakers' processing of words of the different types. It is beyond the scope of this paper to suggest how degrees of irregularity might be expressed formally, but the data presented here suggest that an attempt would be worthwhile.

1

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2

I will restrict the discussion to non-verbs (nouns, adjectives, adverbs, prepositions, and function words). Stress on verbs is morphologically governed, and is generally considered independently (see e.g. Harris 1983).

3

Since there were few developmental differences in the data, Table 3 combines data from all three age groups.

4

One might ask whether children's greater difficulty with sósenga and pánaguil types (as opposed to bochaca types) might be due to a general effect of the closed penultimate or final syllable, as opposed to an effect specific to antepenultimate-stressed words. As Table 3 shows, panaguil types were not in general harder than bochaca types, because the final consonant changed the basic regularity versus irregularity of the word. (Regular) panaguíl types were easier than (irregular) bochacá types, while (irregular) panáguil types were harder than (regular) bochaca types. In contrast, sosenga types were harder than bochaca types regardless of stress placement. Crucially, though, the difficulty posed by the closed penultimate was greater for antepe-

nultimate-stressed words than for penultimate- or final-stressed words.

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