Lexical stress and reading: a study with children

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Abstract

Introduction. Stress in Spanish is associated with an orthographic mark that indicates stress, but there are also other clues that point to it. Most words have the same stress (on the penultimate syllable), and closed syllables (syllables ending in a consonant) attract the stress. In this paper we study these clues, and consequently the function of stress as one of the phonological codes that intervenes in the reading process.

Method. The study was performed with children who had little reading experience, much more prone to use the phonological route. A naming task was used, and stress was manipulated, as well as the regularity-irregularity of the syllabic structure with regard to stress.

Results. There were no differences between words according to their stress, whether it fell on the last or penultimate syllable. However, there were differences dependent on whether words were regular or irregular. The former were read with fewer errors.

Discussion. This result was interpreted as evidence of the functional relationship of stress with the syllabic structure, as well as of its role in the lexical access process which is performed during reading. Finally, we discuss the suitability of including prosodic variables as part of programs for training in phonological awareness.

Keywords: lexical stress, lexical access, reading, children.

Introduction

Reading is a complex activity, due both to the quantity and to the diversity of cognitive operations that intervene. In very general terms, the types of processes carried out are as follows. Initially, processes of visual analysis address identification of the letters that form the words. This is followed by lexical access processes, which search for the meaning and other word characteristics in the mental lexicon. Later, syntactic processes group the words into syntagmas, then group syntagmas with each other, in addition to determining what role each syntagma plays within the sentence. Finally, semantic processes fulfill the function of extracting meaning from the text and of integrating that information with other knowledge stored in long-term memory. Within this theoretical framework, research presented here focuses on stress as one of the phonological codes that children can use as a clue in order to access the written word lexicon.

Stress and lexical access

Sufficient evidence has been accumulated to date which indicates that the process of lexical access is mediated phonologically (Frost, 1998). Some of the proposed phonological codes refer to phonemes and groups of phonemes (e.g., Coltheart, 1978), as well as to syllables (e.g., Carreiras, Álvarez & de Vega, 1993; Domínguez, de Vega & Cuetos, 1997; Álvarez, de Vega, & Carreiras, 1998; Álvarez, Carreiras & de Vega, 2000). However, in Spanish there are other possible codes. In some cases stress is the only clue available in order to distinguish between similar words (e.g., *mato* and *mató*, *saco* and *sacó*, *sábana* and *sabana*, *jugo* and *jugó*, etc.), hence the interest in studying stress. On the other hand, the role of stress has been demonstrated in lexical access carried out in the auditory modality (Cutler, Dahan & Donselaar, 1997; Soto, Sebastián-Gallés & Cutler, 2001). If we start from the possibility that reading and listening to a word involve use of a common phonological representation (Borowsky, Owen & Fonos, 1999; Haist, Song, Wild, Faber, Popp, & Morris, 2001), there is reason to think that stress forms part of that, and can influence recognition processes in the written modality as well.

If we assume that the previous hypothesis is true, the next question would refer to clues that indicate stress in written language. The most obvious is the accent mark, which is perfectly related to stress. Next is readers' implicit knowledge about the most frequent stress, which in Spanish falls on the penultimate syllable (Harris, 1995). Finally, syllabic structure

also is an indication of stress according to the rule that assigns stress to the penultimate syllable unless the last syllable is closed (ending in a consonant) (Alonso-Cortés, 1998). In this paper we study new readers' use of this information, especially with respect to the last two clues.

Evidence of the role of stress in the lexical access process

Research carried out on this topic offers evidence that stress is assigned according to the clues described above. Regarding the accent mark, Domínguez and Cuetos (1998, 2002) manipulated the stress of two words (using the accent mark), presenting one followed by the other (in other words, according to a *priming* procedure). In one condition, the identity case, both stress and spelling are the same (*RASGO – rasgo*). In another condition, incongruent stress, only the spelling was the same (*RASGÓ-rasgo*). Finally, in the control condition, or congruent stress, only the stress was the same (*PERSA-rasgo*). In addition, they manipulated the time elapsed before the second word appeared, as measured from the beginning of the first word (that is, the SOA), and the task they used was lexical decision. In the first experiment (with an SOA of 32ms), they found that the identity condition was faster than the incongruent stress condition (*RASGO-rasgo* as compared to *RASGÓ-rasgo*), while there were no differences between the congruent and incongruent stress conditions (*PERSA-rasgo* as compared to *RASGÓ – rasgo*). In their interpretation, they argue that there were no differences because in the two cases effects of the same magnitude but in different directions were added together. In the incongruent stress condition, facility due to word spelling could have been counteracted by inhibition due to stress. In the control condition the opposite could have occurred. In order to confirm this, Domínguez and Cuetos compared the incongruent condition with two control situations (experiment 2). In one of these, the two words shared the same stress (*PERSA-rasgo*), while in the other situation they did not (*DORMÍ-rasgo*). The comparison between the incongruent condition and the second control allowed them to isolate the spelling component, while the comparison between the two control groups served to isolate the prosodic component. In the first case (*RASGÓ-rasgo* as compared to *DORMÍ-rasgo*), reaction times were less than in the incongruent condition. In the second case (*PERSA-rasgo* as compared to *DORMÍ-rasgo*), there was an advantage in the first control, suggesting that stress influences the lexical access process beginning very early on.

In addition to the accent mark, there are other graphic characters related to stress in other languages. Kelly, Morris and Verrekia (1998) indicate this in the case of English. For

example, in English, the presence of more letters than necessary to represent a word's final phoneme in its pronunciation is a sign that the stress falls on the last syllable. Such is the case of the word *discuss*, where the last *s* is not necessary for pronouncing the phoneme /s/ but which does indicate final-syllable stress, as compared to *discus*, where the absence of the final *s* indicates stress on the prior syllable. Therefore, some letters in final position could be considered analogous in function to the Spanish accent mark, even though their relationship with stress is not perfect. Kelly et al. studied what happened when this rule was not met, with words that stress the penultimate syllable, despite their being marked as final-syllable stress according to above criterion. They compared marked words and non-marked words by using lexical decision and word naming tasks. The result was longer reaction times in the case of marked words, which the authors interpret as proof that stress somehow intervenes in the lexical access process carried out in English.

Readers' implicit knowledge about which stress type is most frequent also has been shown to be a relevant clue, even though research has produced contradictory results. In most studies the main manipulation consisted of comparing words according to the frequency of their stress type (for example, words with last-syllable stress as compared to penultimate-syllable stress). The most common result when using word naming tasks is that reaction times are shorter for words with the most frequent stress type (Colombo, 1992; Sbisa, Zorzi & Tabossi, 1998), and that with the lexical decision task there are fewer errors (Black & Byng, 1986; Colombo, 1992; Gutiérrez, Palma & Santiago, 1998). These results suggest that readers assign a default stress which corresponds to the most frequent one in their language. However, there is also evidence against this hypothesis. When two word lists are compared, whether they all have the same stress or whether stress is variable, no differences were found (Cutler and Clifton, 1984). Therefore, advance knowledge of a word's stress does not imply any advantage. This result was found in English, and it questions whether stress fulfills any function in lexical access in this language.

Besides the accent mark and the most frequent stress type, syllabic structure is another factor to take into account given its close relationship to stress. In this line, there is evidence to indicate that syllabic structure is a good clue which is used to assign stress in written words. Miceli and Caramazza (1993) studied the case of a patient diagnosed with acquired dyslexia whose ability to access the phonological lexicon was impaired, though he still retained the capacity to use rules. When the task consisted of reading words aloud, the patient committed more errors on words that had an irregular stress, that is, words where the stress

did not match what it should have been according to its syllabic structure (for example *cáliz*, which should have final-syllable stress due to its CV-CVC structure). Later, Cappa, Nespor, Ielasi and Miozzo (1997) found the same result with an aphasic patient. Both studies were done in Italian, and with patients who had suffered a brain lesion. Thus one could ask what would happen in other languages and with normal subjects. In response to this question, Gutiérrez (2003) obtained similar results in Spanish. When comparing regular words (for example, *casa*, which should have penultimate-syllable stress due to its CV-CV structure) and irregular words (for example *cáliz*), more errors were found in the second case than in the first, and furthermore, these differences disappeared when the words were written with an accent mark.

Stress and reading in children

To the best of our knowledge, there are no studies which have analyzed these issues in the child population. However, there is indirect evidence that justifies the research we undertake in this study. On one hand, it is known that children very quickly learn the rules for assigning stress in speech, and that they do not simply memorize the stress of each word (Hochberg, 1987a, 1987b). On the other hand, there is evidence that Spanish children make use of the syllabic structure in order to read. Consequently, they make more errors in words with a more complex syllabic structure. This occurs in children between 7 and 12 years of age, independently of their reading competence (Defior, Justicia & Martos, 1996).

Given that children know the rules for assigning stress in oral language, and in addition, their reading is affected by syllabic structure, it is plausible that they learn relatively early on the relationship between stress and syllabic structure in written language. This possibility was checked recently by Gutiérrez (in press), who used a lexical decision task with children in second grade to compare regular and irregular words (according to their structure-stress relationship). The result was that regular words (e.g., *calor*) were recognized with fewer errors than irregular words (e.g., *café*). Differences found were only marginally significant, although in a later regression analysis a positive correlation was obtained (only for regular words) between errors made on the task and on a prior test of reading nonwords. Errors in the reading of nonwords are an indication of knowledge of phonological rules, therefore it is logical that the more errors are committed with these, more errors will also be produced on words which follow the rules. It could be hoped, however, that such a relationship would not be found with irregular words, which are exceptions. This was exactly what took place.

Lexical access models that incorporate stress

To the best of our knowledge, models by Black and Byng (1986) and by Rastle and Coltheart (2000) are the only ones which integrate stress in any of the phases of the lexical access process. Both are dual-route models, but they differ in their propositions about how stress is assigned and used. In the Black and Byng (1986) model, the procedure consists of counting the vowels in the words in order to identify their syllables. This is the only necessary information, since stress is defined by the relationship (strong-weak) that is established between them. Afterward, one assigns the most-frequent stress type for this number of syllables (e.g., stress on the penultimate syllable[1]). Using this stress type as a guide, the lexical search begins with the stressed syllable, and only afterward does it take into account the rest of the phonological and semantic information. If in the first cycle one finds the adequate lexical entry, the process stops; if not, the entire cycle is repeated, assigning the second most frequent stress type.

In the Rastle and Coltheart (2000) model, assignment of stress stems from a morphological analysis of the word. According to regularities in the English language, the procedure would be as follows. First, prefixes are found. When detected, their pronunciation is recovered directly from the lexicon, while the rest of the word is transcribed according to grapheme-phoneme conversion rules (henceforward GPC). Once this is done the final result is verified, in order to ensure that the last two elements of the phoneme chain do not violate some phonotactic rule. If some rule were broken, the last syllable would be stressed; if not, the GPC rules would be applied to the whole word, and stress would be assigned to the first syllable. If prefixes are not found, one searches for suffixes. Since it is possible to find more than one, this procedure is repeated several times (it is recursive) until all suffixes are identified. If one is detected, its pronunciation would be found in the lexicon, and, except in a few cases (such as the suffixes *-een*, *-ique* and *-oo*), stress would be assigned to the first syllable. The rest of the word would be transcribed according to GPC rules. If, on the contrary, no suffixes were found, the first syllable would be stressed and GPC rules would be applied to the rest of the word.

Rastle and Coltheart found that, out of a corpus of 23266 entries, this algorithm assigned stress correctly in 89.7% of cases, and in 95% of words with stress on the penultimate syllable. On the other hand, in a task of reading nonwords, the predicted stress matched observed stress in a good number of cases (experiment 2). Finally, regular words (whose stress

matched what the algorithm assigned) were read more quickly and with fewer errors than irregular words (whose stress did not match). These differences were more acute in the case of low-frequency words (experiment 3).

This algorithm substitutes the non-lexical route in the DRC model (Coltheart & Rastle, 1994; Rastle & Coltheart, 1998, 1999, 2000). Proposing a Spanish-specific algorithm goes beyond the objectives of this paper; however, we can say that any proposed algorithm should consider the factors which can influence assigning stress in Spanish. As explained above, these include that the majority of words are stressed on the penultimate syllable, and that closed syllables attract stress. Both factors are combined in a general rule stating that stress falls on the penultimate syllable, unless the final syllable is closed, in which case the latter receives the stress (Alonso-Cortés, 1998). It would thus appear that any algorithm proposed should work from the end of the word. However, this would lead to errors in those cases where the stress is indicated at the beginning of a word with an accent mark. In order to avoid this, the direction would have to be left-to-right and syllable by syllable[2]. In this paper we wish first to confirm whether the variables mentioned above influence assignment of lexical stress in Spanish. The way in which they do so would have to be investigated in later studies, thus elaborating a lexical access model that incorporates stress.

Research approach

The child population is ideal for studying how phonological codes which intervene in the lexical access process are used, and therefore, how stress is used as another case of a phonological code. The orthographic lexicon is not highly developed in children (Jiménez, Guzmán & Artiles, 1997), so the phonological route carries more weight. This is especially true in *transparent* languages such as Spanish (Defior, Martos & Cary, 2002).

According to the clues which indicate stress in Spanish, the following predictions can be made. In the first place, words with an accent mark would have to be identified first. This is so because no rule need be applied to them, the orthography of the word directly indicates the stress. Likewise, words which stress the penultimate syllable would have an advantage, since their stress is presupposed by default. Finally, regular words (whose stress matches that indicated by their syllabic structure) should be read better than irregular words. Of these three predictions, the first is the most difficult to verify. The accent mark not only indicates stress, but also is a graphic character. Therefore, any difference found between words written with or without an accent mark could have both a phonological and an orthographic origin. For

this reason, we studied the last two predictions, writing words in capital letters and without accent marks, so that there would be no explicit clue about where their stress would fall.

According to the Black and Byng (1986) model, only the prediction referring to most frequent stress would be fulfilled, and not the other prediction which we will examine in our study. Thus, one expects that words stressed on the penultimate syllable will be recognized sooner. This would be so, since, according to this model, lexical search begins with this type of word. However, the prediction that would be made according to a DRC model, where one considers syllabic structure, would not be so simple. As explained above, adapting this model to Spanish would involve taking into account the rule that any word is stressed on the penultimate syllable unless its final syllable is closed, in which case the final syllable is stressed. Thus, one would not expect to find differences between words stressed on the penultimate syllable and regular words stressing the final syllable, since the latter would end in a closed syllable. However, differences should be found between regular and irregular words (e.g., *casa* and *cajón*, as compared to *sofá* and *túnel*).

These two predictions have already between verified by Gutiérrez (2004), using a lexical decision task for this purpose. Results indicate that regular words are recognized with fewer errors. This was probably due to syllable structures which led to words being read with incorrect stress (that is, sofá and túnel are read as SO-fa and tu-NEL), such that they appear to be nonwords. In order to confirm this, in the experiment described below we used the same stimuli and worked with a different task, in this case reading words aloud. Special attention was given to irregular words, where we expected more stress errors to be produced.

Method

Participants: The participating children were the same ones who had taken part three months earlier in an investigation by Gutiérrez (in press), that is, 18 third-grade pupils (12 girls and 6 boys) from the Cristo Rey school in Jaén. The average age was 99.22 months (SD= 3.6) and they had learned to read by following a mixed method, combining characteristics of global and phonetic methods. All of them were evaluated as normal readers by their schoolteacher.

It is possible that in such a long interval of time the children's reading skill had improved, so that it were more difficult to find phonological effects because their orthographic lexicons had become more developed. However, the three-month period corresponded to their summer vacation, when it is not usual for any reading-related instruction to take place.

In fact, it is more likely that their reading would have deteriorated from lack of practice. Such is the case, for example, when the study of a second language is interrupted, a phenomenon known as *attrition* (Echeverría Munárriz, 1999).

In order to evaluate the children's use of phonological codes, we used scales 5 (reading of words) and 6 (reading of words and nonwords) from the PROLEC battery (Cuetos, Rodríguez & Ruano, 1996). Errors in reading nonwords from both tests were calculated (see appendix I). In the PROLEC it is not stated what constitutes an error, so we considered that any deviation from fluent reading of a word would be an error. This included reading where the student corrects himself (*es-esbetulporión*), pronouncing syllable by syllable (*es-be-tul-po-rión*) and pauses (*esbetul-porión*). This way we had a measurement which was sensitive enough to allow for a later regression analysis of errors in reading regular and irregular nonwords in the experiment. Through this analysis we would obtain an index of the phonological origin of the errors. It was expected that there would be a positive correlation in the case of regular words, whose pronunciation follows the phonological rules of Spanish. It was likewise expected that in irregular words the correlation would not be as clear, or might even be negative, given that these were exceptions to the rules.

Instruments: A 486 computer was used to present the words, and a vocal device registered latencies of vocal naming. Experiments were prepared using the MEL program, version 2.01 (Micro Experimental Laboratory: Scheneider, 1989). Participants were evaluated using the PROLEC battery (Cuetos et al, 1996).

Materials: 56 bisyllabic words were selected from Justicia's dictionary of frequencies (1995), ranging from 2 to 1445 occurrences (from a total of 255711 possible). From this set, 36 regular words were chosen (where the stress matched that indicated by their syllabic structure). These were assigned to two lists, 18 penultimate-syllable stress, and 18 final-syllable stress, equalized for lexical frequency (Justicia, 1995) and for positional frequency of the first syllable (Justicia, Santiago, Palma, Huertas & Gutiérrez, 1996). In addition, a list of 12 regular words was drawn up (of which 4 words were also included in the prior set of 36) and another list of 12 irregular words was drawn up, equalized for the same variables and for their stress.

Out of 56 total words, 34 were penultimate-syllable stress and 22 were final-syllable stress. In order to end up with the same number of words of both types, 12 words with final-syllable stress were added to fill in. Appendix I shows words used in this experiment.

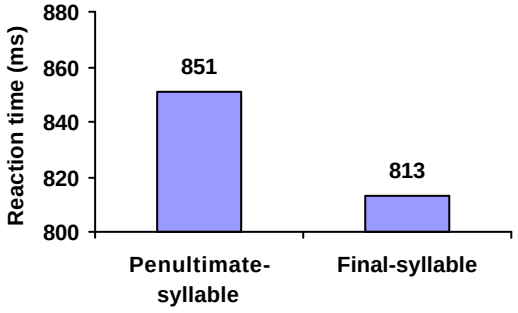
Design: There were two variables, **stress** (words with penultimate- and with final-syllable stress) and **syllabic structure** (regular and irregular words), which were manipulated intra-subject, and were not crossed factorially [3].

Procedure: The experiment was done in two sessions performed on two days. Each session lasted approximately 20 minutes. In the first, children took an individual reading competency test, the PROLEC, in order to evaluate their use of phonological codes while reading words. More specifically, scales 5 and 6 were given. Errors in reading nonwords were measured, so that more errors suggested a lesser knowledge of phonological rules.

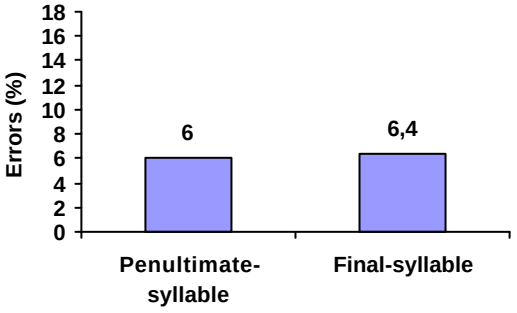
In the second session, we used a standard task for reading words. For each trial, students first heard a beep (1000Hz) during 50 ms. Afterwards a signal (+) was presented, which remained for 450 ms in the center of the computer screen. The screen went blank and stayed blank for another 500 ms. Finally, the word to be read was presented, remaining until it was named, or until a maximum of 3 seconds had passed. Words were shown in capital letters and without accent marks[4], in a different order with each participant.

Results

On the ANOVA of reaction times, we excluded trials where some mistake was made, and trials that did not fall within an interval of 200 to 2000 ms. In the case of the **stress** variable, differences were marginally significant only by subjects [F1(1, 17)= 3.28, $p < 0.10$; F2(1, 34)= 2.43, $p > 0.10$]. In the case of errors there were no differences [F1(1, 17) < 1; F2(1, 34) < 1].

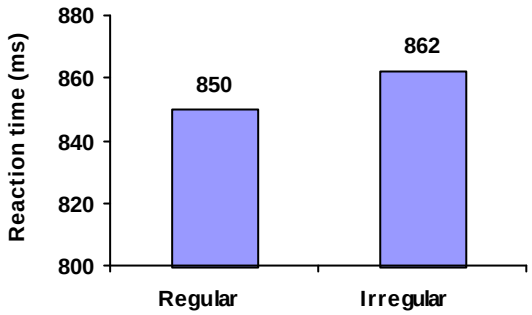


Graph 1. Mean reaction times by subjects

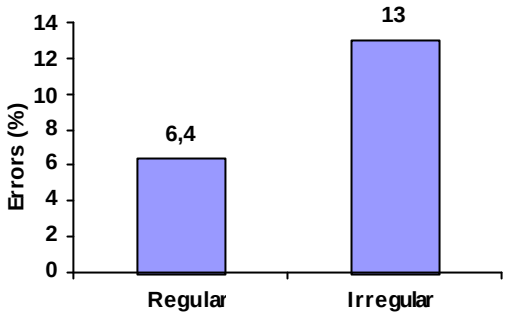


Graph 2. Means of the percentage of errors by subjects

In the case of the ANOVA for reaction times for the variable **syllabic structure,** no significant differences were found [F1(1, 17) < 1; F2(1,34) < 1], while they *were* found, though only by subjects, in the case of errors [F1(1, 17)= 22.13, p < 0.05; F2(1,34)= 2.55, p > 0.10].



Graph 3. Mean reaction time by subjects



Graph 4. Means of the percentage of errors by subjects

An additional descriptive-type analysis was performed with errors, in order to check whether stress errors were produced (e.g., *chándal* read as *chan-DAL*). In regular words there were no cases of this type of error, while they did exist on 6 of the 12 irregular words. Specifically, for *cárcel*, 40% of errors produced were on stress, for *póster* the percentage was 43%, for *túnel* and *chándal* 50%, while on *sofá* and *café* it was 100%.

A regression analysis was performed on errors and by subjects in order to check where there was a relationship between the use of phonological codes and errors committed on regular and irregular words. The prediction we started with was that the greater the use of this type of code (that is, the fewer errors were committed in the reading of nonwords), the fewer errors would be produced on regular words (which follow the rules), while on the irregular words this relationship should not be found, or it might even be the opposite. In order to estimate the use of phonological codes, we calculated errors made in reading nonwords from PROLEC tests 5 and 6, such that the more errors were commited, the more limited we considered to be their usage of phonological codes.

Results indicate that the correlation was positive in regular words, â= 0.59 [F(1, 16)= 8.5, p < 0.05]. The value of the adjusted R^2 coefficient was 0.30, so the the percentage of explained variance reached 30%. On the irregular words, the correlation was also positive,

although only marginally significant, â= 0.42 [F(1,16)= 3.37, p < 0.10]. In this case, the percentage of explained variance was only 12%.

Discussion

In this experiment we put two predictions to the test, predictions formulated on the basis of factors which determine assignment of stress in Spanish. On one hand, we expected that words with penultimate-syllable stress would be read more quickly and with fewer errors than words with final-syllable stress. On the other hand, we expected that regular words would have the advantage over irregular words. According to the Black and Byng (1986) model, only the first prediction should be fulfilled, since assigning lexical stress is based only on a default presupposition that the majority of words have the same stress. However, if we take into account the rule that words have penultimate-syllable stress except if the last syllable is closed, then differences should be found only between words that follow this rule and those that do not follow it.

Results from this experiment do not confirm the first prediction, in fact they are contradictory to it, since final-syllable words were faster. Although it was a weak effect, marginally significant only by subjects, it agrees with certain previous results that are found also in adults. In general, naming latencies are greater when the stress is at the beginning of the word (Gutiérrez, Palma & Santiago, 2001). This may be due to a specific characteristic of the word naming task, that is, production of the first phonemes can be planned very early, since word spelling gives a good number of clues which allow for this. For example, graphemes present in the word can activate syllables associated with their phonemes in the syllabary (Levelt, Roelofs & Meyer, 1999). Since unstressed syllables are more frequent, it is to be expected that a certain delay is produced when the first syllable is stressed, due to competitive processes that may be taking place.

As for syllabic structure, results are analogous to those found by Gutiérrez (in press). More errors were made on irregular words, given that the rules relating stress to syllabic structure lead to an incorrect assignment of stress for this type of word. A subsequent regression analysis points in the direction of these differences being due to phonological factors. In the case of regular words, there was a positive correlation with errors in the reading of nonwords. Therefore, the fewer the errors of this type that were produced, the fewer the errors made on words which followed Spanish phonological rules. However, in the case of irregular words, the positive correlation was only marginally significant. This is logical if one takes

into account that this type of word does not follow all the rules, specifically those that refer to assigning stress. From another point of view, the correlation found for these could have been due to them being regular with regard to applying GPC rules.

As a whole, this pattern of results confirms the prediction that stress is assigned taking syllabic structure into account. A model should be proposed which incorporates syllabic structure as one of the factors determinining assignment of stress in Spanish. Moreover, the relevance of syllabic structure is confirmed as one of the variables which influences reading in children (Defior et al, 1996).

Finally, these results suggest that the concept of phonological awareness should perhaps be extended to include variables such as stress and syllabic structure. Then one might speak of a kind of *metric awareness* that could be at the root of learning to read and of reading disabilities. Given that both factors are important for reading, it would seem logical that children should be instructed in their use. One common task of phonological awareness which could be combined with this type of training is that referred to as rhyme; in Spanish this would be syllabic rhyme. Since rhyme determines the *weight* of the syllable, exercises could be developed where stress and structure of the final rhyme are manipulated (e.g., *V* for penultimate-syllable stress, or *VC* for final-syllable stress). The children's task should be to indicate if the words rhyme, considering their stress as well. The effectiveness of this type of training is an empirical question which remains to be confirmed in future research.

Notes

1. In Spanish, 90 % of words are stressed on the penultimate syllable (Harris, 1995).

2. The syllable is a functional unit for reading in Spanish, both in adults (Carreiras, Álvarez, & de Vega, 1993) as well as in children (Jiménez, Guzmán & Artiles, 1997).

3. The number of irregular words with penultimate- and final-syllable stress was insufficient for combining the two variables in a factorial design.

4. Even though the Real Academia (1991) stipulates that upper case letters are governed by the same rules as lower case, in practice one usually sees words written in upper case without accent marks. For this reason, we did not expect to find differences due to this factor.

Authors' Note

This study was partially funded by the DGIGYT, through the project "Structural frameworks and their use in language perception, production and acquisition", reference BS02002-02993.

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Appendix I

Words			
Penultimate-Syllable Stress	**Final-Syllable Stress**	**Regular**	**Irregular**
CABLE	COLLAR	COMPRA	CAFE
LABIOS	CARTEL	LLUVIA	SOFA
FERIA	CLAVEL	PIPAS	FUTBOL
POLLO	PODER	TORRE	TUNEL
CHICLE	PASTEL	RAIZ	ANGEL
COMPRA	PORTAL	PAIS	CESPED
LLUVIA	PERDIZ	BIBLIA	CARCEL
PIPAS	SEÑOR	FOLIO	POSTER
TORRE	TAMBOR	CUEVA	CHANDAL
MEDIAS	BUZON	LENGUA	ARBOL
UÑAS	TAPON	GAFAS	LAPIZ
CARNE	BALON	SILLA	ALBUM
PATIO	CAJON	Lexical frequency	
HUEVOS	BOTON	195.16 (423.65)	196.75 (401.18)
TABLA	JAMON	Frequency of the first syllable	
LETRA	MELON	63.83 (67.95)	73.66 (99.70)
JARRA	CORDON	Frequency of the final syllable	
GORRA	CARTON	17.66 (33.09)	5.91 (6.08)
Lexical frequency			
45.39 (31.63)	44.55 (32.07)		
Frequency of the first syllable			
84.55 (90.50)	92 (99.74)		
Frequency of the final syllable			
20.50 (24.98)	8.66 (6.27)		

Numeric values are means, and standard deviation is shown in parenthesis. The value of syllabic frequency represents the different words that shared the syllable in this position (meaning, therefore, a data type *type*). This data is preferred to values of the *token* type because they are in a scale which facilitates comparison between conditions.

Reading nonwords on the PROLEC	
Test 5	**Test 6**
4.27 (2.67)	5.66 (1.91)

The first value corresponds to the mean of errors committed. Standard deviation is shown in parenthesis.