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J. Experimental Child Psychology 92 (2005) 161–181

Journal of
Experimental
Child
Psychology

www.elsevier.com/locate/jecp

Vowels, syllables, and letter names: Differences between young children's spelling in English and Portuguese

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Received 17 September 2004; revised 7 January 2005

Available online 8 March 2005

Abstract

Young Portuguese-speaking children have been reported to produce more vowel- and syllable-oriented spellings than have English speakers. To investigate the extent and source of such differences, we analyzed children's vocabulary and found that Portuguese words have more vowel letter names and a higher vowel–consonant ratio than do English words. In a spelling experiment, we found that Portuguese speakers used more vowels, but did not produce more syllabic spellings, than did English speakers. The differences that we observed are attributable to quantitative differences in the languages and their writing and letter name systems. They do not support the widespread idea that speakers of Romance languages pass through an additional, syllabic, stage of development.

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Keywords: Spelling development; Cross-linguistic study; Letter names; Vowels

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Introduction

Because most research on reading and spelling has studied English, our understanding of literacy and its development may be constrained by the characteristics of English and its writing system, which might not generalize to other languages. In an attempt to broaden our knowledge, researchers have recently turned to cross-linguistic studies. This research (e.g., Aro & Wimmer, 2003; Defior, Martos, & Cary, 2002; Seymour, Aro, & Erskine, 2003) has tended to focus on reading. Our goal in the current study is to extend the investigation to spelling by examining the early acquisition of spelling in two writing systems: those of Brazilian Portuguese and American English. Several differences have been reported between spellings produced by English speakers and those produced by speakers of Romance languages such as Portuguese, Spanish, and Italian. Here we address two of the most prominent claims: (a) that early spellers in the Romance languages use a disproportionate amount of vowels, often omitting consonants entirely, and (b) that they tend to spell syllabically, writing one symbol per syllable. Such observations are rarely adduced for early writers of English. We describe new studies designed to determine whether there are indeed cross-linguistic differences along these dimensions and, if so, to what extent such differences can be explained by differences in the languages themselves or in their writing systems.

Among English-speaking children, vowels are a major locus of children's spelling mistakes (Read, 1986; Treiman, 1993; Varnhagen, Boechler, & Steffler, 1999). Kamii, Long, Manning, and Manning (1990) reported that English-speaking kindergartners sometimes represent only consonants in their spellings. The opposite pattern is more commonly reported among speakers of Romance languages, where all-vowel spellings, such as *AO* for Spanish *sapo* 'frog' (Ferreiro & Teberosky, 1982), and *UUU* for Portuguese *urubu* 'vulture' (Nunes Carraher & Rego, 1984), are often cited. Although little quantitative data exist, the reports suggest some important differences between use of consonants and vowels in English and in other languages.

Another apparent difference between early spelling in Romance languages and English involves syllabic spellings. Ferreiro and colleagues (Ferreiro, 1990; Ferreiro & Teberosky, 1982; Vernon & Ferreiro, 1999) reported that young Spanish-speaking children often write one symbol per syllable. Reports of syllabic spellings among preschool children are frequent not only in Spanish but also in other Romance languages such as Italian (e.g., Pontecorvo & Zuccheromaglio, 1988) and Portuguese (e.g., Martins & Silva, 2001). The syllabic stage is a crucial intermediary stage in Ferreiro's theory of spelling development, where it is taken to be the child's first attempt to encode the sounds of language. In Romance-speaking countries, Ferreiro's theory is by far the predominant paradigm for explaining young children's spelling acquisition, to such an extent that early literacy instruction is generally approached as an effort to guide children out of the presyllabic stage of spelling and into the syllabic stage (Silva & Alves-Martins, 2002). In contrast, the only report we could find of syllabic spellings among English-speaking children was that of Mills (1998), who studied 4- and 5-year-olds. A syllabic stage does not play a role in the prominent theory of Frith (1985), who

mentioned only a transition from a logographic stage to an alphabetic (phonemic) stage. Other researchers have reported that children learning English rarely or never spell words in a syllabic manner (Kamii et al., 1990; Sulzby, 1985).

It would be surprising if spelling development in Romance languages differs so radically from spelling development in English. English-speaking children have syllabic awareness and the ability to manipulate syllables before they can manipulate individual phonemes (Liberman, Shankweiler, Fischer, & Carter, 1974; Treiman & Zukowski, 1996), and in both languages the target spelling system is phonemic, with no trace of syllabic orientation. If the syllabic stage of development is a universal of child development, we would not expect children from different cultures to develop so differently in the face of substantially similar environmental inputs.

How then could we account for any difference in early spellings between English- and Portuguese-speaking children? Several types of explanations may have some bearing on the matter. One tack would be to look for categorical differences in the structure of the languages themselves. For example, the rhythm of the sentence is said to be based on syllables in the Romance languages, whereas it is based on stress in English (Pike, 1945); syllable-based rhythm may make syllables and vowels more salient for Romance speakers (Kamii et al., 1990). The syllable structure of English differs from that of Romance languages in that the former allows multiple consonants to follow the vowel of the syllable (Blevins, 1995), and this may distract attention from the vowels. Another tack is to look for more graded differences in the languages. Ferreiro and colleagues (e.g., Ferreiro, 1990) emphasized that English has more one-syllable words than does Spanish, and Kamii et al. (1990) pointed to the relative unclearness of many of the unstressed vowels in English. Such differences may account for somewhat greater attentiveness to vowels in the Romance languages, but they would not lead to huge, nearly categorical differences in children's spellings.

Another approach to explaining cross-language differences in spelling is to look for differences in the consistency of the mapping from sounds to letters. In English, vowels are much more inconsistent than consonants (Kessler & Treiman, 2001). Perhaps young English spellers omit vowels because vowels are just too difficult. But that would not explain why children omit consonants in Romance languages, for consonants are not particularly inconsistent in these languages. In Portuguese, as in English, vowels tend to be much more difficult to spell than do consonants. For example, /i/ may be spelled *i* or *e*, and /u/ may be spelled *u* or *o*. Sometimes contextual cues can help to determine how to spell vowels. For example, in Brazilian Portuguese, /i/ and /u/ are nearly always spelled *e* and *o* in unstressed final syllables but usually *i* and *u* otherwise. However, beginning spellers might not be aware of these contextual rules, making the vowel system in Brazilian Portuguese all the more inconsistent. (For an explanation of the phonetic symbols used in this article, see International Phonetic Association, 1999.)

If differences in consistency are not sufficient to explain the apparent differences between the languages, perhaps we should look at differences in the letter name systems (Table 1). In many countries, children typically learn the names of the alphabet letters at an early age. A growing body of research shows that young children may adopt a letter name strategy in their early attempts to spell. The most basic letter

Table 1
Letter names in Brazilian Portuguese and American English

Letter	Brazilian Portuguese	American English
A	/a/	/e/
B	/be/	/bi/
C	/se/	/si/
D	/de/	/di/
E	/e/	/i/
F	/ʼɛfi/	/ɛf/
G	/ʒe/	/dʒi/
H	/a'ga/	/ɛtʃ/
I	/i/	/aɪ/
J	/ʼʒɔta/	/dʒe/
K	—	/ke/
L	/ʼeli/	/ɛl/
M	/ʼemi/	/ɛm/
N	/ʼeni/	/ɛn/
O	/ɔ/	/o/
P	/pe/	/pi/
Q	/ke/	/kju/
R	/ʼɛhi/	/ɑɪ/
S	/ʼesi/	/ɛs/
T	/te/	/ti/
U	/u/	/ju/
V	/ve/	/vi/
W	—	/dʌblju/
X	/ʃis/	/ɛks/
Y	—	/waɪ/
Z	/ze/	/zi/

Note. Letters that are not part of the core alphabet of Portuguese are marked with a dash.

name strategy is to take letters as spelling their entire name. For example, Treiman (1994) found that a nonword such as /vaɪ/ was frequently spelled as VR, where R stands for the name of the letter, /ɑɪ/; vowel omission was less common when the vowel did not form part of a letter name with an adjacent sound. Other data suggest that beginning spellers are more likely to include a vowel in their spelling when the vowel is a letter name than when it is not (Treiman, 1993). Such findings apply to other languages where children learn letter names at an early age. Levin, Patel, Margalit, and Barad (2002) found that Hebrew-speaking Israeli kindergartners were more likely to spell words with letters whose names were found in the word. Martins and Silva (2001) reported that Portuguese-speaking children were more likely to use a phonetically accurate letter when the letter's full name occurred in the word. In addition, Cardoso-Martins and Batista (2003) showed that Brazilian Portuguese-speaking preschoolers often use a phonetically plausible letter in their spelling when the sound corresponds to a letter name at the beginning of the word.

Given the role of letter names in literacy acquisition, asymmetries in letter name systems could lead to different patterns in the spellings of young children. Because of differences in letter names between languages, and because of differences in vocabularies, languages can vary to a great extent in how many letter names are found in

words and in the relative frequency with which the different letters are so represented. Cardoso-Martins, Resende, and Rodrigues (2002) began this line of inquiry with Portuguese by showing that, of the 56 most common Portuguese content words in books for Brazilian kindergartners, 51 contained at least one vowel letter name in their pronunciation. On a similar list of 56 high-frequency English words, only 17 contained a letter name. These facts suggest important differences between the languages that may account for some of the general observations about children's spelling. For example, perhaps the many vowel letter names in Portuguese words encourage children to write vowel letters when spelling. Detailed examination of larger word lists is needed to confirm the generalizability of these findings and to highlight differences between vowels and consonants. Such large-scale analysis has so far been limited to English. Working with a list of 6232 words from kindergarten and first-grade reading materials (Zeno, Ivens, Millard, & Duvvuri, 1995), Treiman and Kessler (2003) found that roughly 50% of the words in this more general child vocabulary contained a letter name. In the current research, we extend this line of work to Portuguese.

Statistical properties of the printed words that children see early in life may also influence the letters they use. Some evidence for this comes from studies that have investigated children's spellings of vowels versus consonants. As discussed previously, Kamii et al. (1990) suggested that English-speaking kindergartners tend to acquire consonants earlier than they acquire vowels. Similarly, learners of Hebrew tend to represent consonants earlier than they represent vowels (Levin, Share, & Shatil, 1996). Tolchinsky and Teberosky (1998) found that when children began to symbolize phonemes with phonologically appropriate letters, Hebrew speakers showed a preference for consonants and Spanish speakers showed a preference for vowels. This difference may be due in part to the types of letters that children encounter most often. In English and especially in Hebrew texts, the proportion of consonant letters to vowel letters is very high. Romance languages may have more vowel letters in text than does English. Mere exposure to different proportions of vowels could be one source of differences in spelling between English and those other languages.

To quantify and understand some of the differences in children's spelling between English and Portuguese, we began in Study 1 by investigating differences in the letter name systems of English and Portuguese and differences in the letter types—vowels and consonants—encountered in the languages. Study 2 presents behavioral data on how children's spelling is influenced by the differential patterns.

Study 1

Methods

Corpora

We used lists of words drawn from corpora of children's reading material used for pedagogical purposes in the respective countries: Pinheiro (1996) for the Brazilian

population and Zeno et al. (1995) for the American population. Because of the smaller sample size of Pinheiro's corpus, we selected only words that appear in both the preschool and first-grade subcorpora at least once. This criterion allowed us to avoid words that occurred adventitiously in only a single preschool text. There were 3621 words in the Brazilian Portuguese list and 6232 words in the American English list. The larger size of the English list is due in part to the fact that Zeno et al. did not provide separate counts for preschool and first grade. In any event, we expect that the spelling and the phonological properties of the word lists in both languages are representative of preschool vocabulary as a whole. The pronunciations of the Portuguese words were added by the first author, using current pronunciations in the city of Belo Horizonte. This accent was chosen because the corpus used in this analysis was drawn from children's books used in the schools in this city. Also, the participants in Study 2 were children in Belo Horizonte. The pronunciations of the English words were taken from the *CMU pronouncing dictionary* (1998).

Analysis and results

Letter name analysis

We first calculated the percentage of words that contain at least one letter name in their pronunciation. We did this for both languages, first over the entire set of letter names and then for each letter name separately. The analysis was broken down by the position of the letter name in the word due to the differential salience of those positions. We do not estimate significance because we computed descriptive statistics over all of the relevant words found in broad and representative corpora, and we are not making predictions about other words in the language. All of the analysis reported here used word type; that is, we did not weight the words by frequency. However, very similar results are found if the words are weighted by frequency.

Table 2 shows the results of the letter name analysis. The row labeled "Any" shows that the percentage of words that have at least one letter name in their pronunciation is twice as great in Portuguese as in English. Letter names are more common at the end of words than at the beginning. This is particularly true of Portuguese; at the end of words, Portuguese has nearly six times the percentage of letter names as does English. In Portuguese, the letter name most commonly found in words is that of *A*, followed by *I* and *U*. In English, the letter name most commonly found in words is that of *E*, followed by *A*, *O*, and *I*. Thus, in both languages, vowel letter names can be heard in words much more often than can consonant letter names.

We also calculated the average number of letter names per word. We performed this analysis with all of the words in the corpora, and we also ran an additional analysis restricted to two-syllable words stressed on the first syllable. There were 1243 such words in the Brazilian Portuguese list and 2271 in the American English list. Two-syllable words were chosen for this analysis because we wanted to compare the languages on the basis of words that have a similar structure in both languages; they are the simplest words that are very common in both English and Portuguese

Table 2

Percentages of words that contain at least one letter name in their pronunciation

Letter	Anywhere		Beginning		End	
	Portuguese	English	Portuguese	English	Portuguese	English
Any	95.3	46.9	20.9	6.1	71.6	12.1
A	61.5	9.5	8.3	0.5	34.5	0.8
B	0.9	0.6	0.5	0.4	0.1	0.2
C	2.7	1.0	1.6	0.5	0.3	0.4
D	2.5	1.1	1.5	0.1	0.1	0.7
E	8.0	16.5	0.4	0.4	0.6	7.9
F	0.0	0.1	0.0	0.0	0.0	0.0
G	0.6	0.2	0.4	0.1	0.0	0.1
H	0.0	0.0	0.0	0.0	0.0	0.0
I	38.8	7.6	3.6	0.4	10.5	0.5
J	0.0	0.2	0.0	0.2	0.0	0.0
K	—	0.7	—	0.3	—	0.0
L	0.2	1.8	0.0	0.2	0.0	0.3
M	0.1	0.6	0.0	0.2	0.1	0.0
N	0.1	2.6	0.0	0.5	0.0	0.3
O	7.6	7.6	0.5	0.6	0.4	1.6
P	1.8	0.9	1.1	0.4	0.0	0.2
Q	0.7	0.1	0.2	0.1	0.1	0.0
R	0.0	2.9	0.0	0.3	0.0	0.2
S	0.2	1.2	0.0	0.0	0.2	0.3
T	1.4	1.2	0.6	0.2	0.1	0.7
U	37.9	1.0	1.2	0.3	24.4	0.1
V	1.8	0.1	0.9	0.0	0.2	0.1
W	—	0.0	—	0.0	—	0.0
X	0.0	0.2	0.0	0.1	0.0	0.0
Y	—	0.5	—	0.4	—	0.0
Z	0.8	0.4	0.1	0.0	0.1	0.2

(Portuguese has relatively few one-syllable words). This procedure also has the advantage of controlling for word length. We used words with the stress on the first syllable because that is the most common stress pattern in two-syllable words in both languages.

Table 3 shows the counts broken down by phoneme type, position in the word, and language. The results indicate that Portuguese has more letter names per word than does English. This difference is due to the number of letter names that are vowels. Portuguese and English words have similar numbers of consonant letter names, but Portuguese words have 4.3 times as many vowel letter names as do English words. At the end of the words, vowel letter names are much more common than consonant letter names; in fact, Portuguese has extremely few words with consonant letter names in this position.

To see how helpful letter names may be for children's initial spelling, we also calculated their reliability, that is, the percentage of cases in which the letter name heard in the pronunciation of the word is spelled at least in part with the corresponding letter in the standard orthography. For example, in English, *ceiling* con-

Table 3

Average numbers of letter names per word and their reliability in English and Portuguese

Type of letter	Portuguese				English			
	Letter names per word		Reliability (%)		Letter names per word		Reliability (%)	
Anywhere in word								
Any letter	2.00	(1.68)	76.0	(70.2)	0.59	(0.66)	79.6	(74.2)
Consonants	0.14	(0.06)	85.7	(85.7)	0.16	(0.18)	87.5	(83.3)
Vowels	1.86	(1.62)	75.3	(69.8)	0.43	(0.48)	76.7	(79.2)
Beginning of word								
Any Letter	0.21	(0.12)	81.0	(91.7)	0.06	(0.06)	83.3	(83.3)
Consonants	0.07	(0.06)	85.7	(83.3)	0.04	(0.04)	75.0	(75.0)
Vowels	0.14	(0.06)	78.6	(100.0)	0.02	(0.02)	100.0	(100.0)
End of word								
Any Letter	0.72	(0.83)	54.2	(49.2)	0.15	(0.23)	53.3	(43.5)
Consonants	0.02	(0.00)	100.0	(—)	0.04	(0.06)	100.0	(83.3)
Vowels	0.70	(0.66)	52.8	(49.4)	0.11	(0.17)	36.4	(29.4)

Note. Results for two-syllable words are in parentheses.

tains the letter name /si/, which sound sequence is partially spelled in that word with the letter that has that name, *c*. In contrast, the English word *seat* has the letter name /si/, but in this word this phoneme string is not spelled with the corresponding letter, *c*, but rather with *s*. In the former example the consonant letter name is counted as reliable, and in the second example it is not. By our definition, a letter name is considered reliable even if the corresponding letter is only part of a multiple-letter spelling. For example, the letter name /e/ is counted as reliable in *make* and *rain* even though additional letters besides *a* are needed to spell the vowel sound accurately in those words. We chose a loose criterion because beginning spellers rarely achieve perfection in such complex spellings, and spelling even the first vowel letter of a digraph correctly goes a long way toward making children's spellings understandable to readers. Another consideration was that Portuguese makes much less use of digraphs than does English, and Portuguese makes no use of the final silent *e* to indicate long vowels; the looser scoring criterion makes the two languages more comparable.

Table 3 shows the aggregated reliabilities. The average reliabilities in English and Portuguese are similar. Overall, the consonant letter names are more reliable than the vowel letter names in both languages. Vowel letter names at the end of the word are especially unreliable. A child using a letter name strategy for spelling would be correct only half of the time in Portuguese and only a little more than one third of the time in English. Consonants are reliable most of the time in both languages. The reliability of consonants at the end of the word is 100%; that is, every time a consonant letter name is heard at the end of a word, it is spelled with the corresponding letter. However, consonant letter names are not very common in this position. The patterns for two-syllable words with the stress on the first syllable are similar to those observed for all of the words.

Letter type analysis

We also performed a set of analyses to determine the ratio of vowels to consonants in the two languages. First, we calculated this ratio in terms of letters in the printed words, counting *y* as a vowel. The ratio of vowels to consonants was much higher in Portuguese (0.88) than in English (.58). Next we calculated this ratio in terms of vowel and consonant phonemes in the corresponding spoken words. These analyses ignored semivowels in both languages due to their intermediate status. Thus, all diphthongs were counted as one vowel. The results were similar to those for consonant and vowel letters: The vowel–consonant ratio was 0.93 for Portuguese and .56 for English. Thus, the vowel–consonant ratio was 52 to 66% higher in Portuguese than in English, depending on whether one counts by letters or by sounds.

Discussion

Study 1 shows that the interaction of the spelling, vocabulary, and letter name systems of English and Portuguese provides raw material that could lead to differential performance in spelling tasks. Here we focus on the data that could lead to differences in the generation of syllabic spellings, in differential preferences for vowels and consonants, and in differential phonetic plausibility of spellings. The applicability of these data will depend, of course, on the actual strategies that children from the two cultures use when they spell, so detailed discussion of the implications of these findings is delayed until after the behavioral data from Study 2 are presented.

Vowel letters, vowel sounds, and vowel letter names are much more common in Brazilian Portuguese words than in American English words, confirming the preliminary observations of Cardoso-Martins et al. (2002). These facts may in part account for the proliferation of vowels reported in the literature for languages such as Portuguese and Spanish (e.g., Ferreiro & Teberosky, 1982; Nunes Carraher & Rego, 1984). To the extent that children rely on a letter name spelling strategy, writing a letter whenever they hear its name in a word, we would expect them to produce nearly two vowels per word, and typically no consonants, in Portuguese. The same strategy would, for most words, fail entirely in English. To the extent that children try to reproduce the properties of text they have seen in their environment, one would expect Brazilian children to write many more vowel letters than U.S. children, simply because Brazilian children have seen many more vowels per unit of text. And to the extent that children spell phonemically using reasonable sound-to-letter correspondences, we would expect Brazilian children to use more vowels than American children because there are more vowels in Portuguese words than in English words. Thus, the basic statistics of the languages and their writing systems may explain why beginning spellers of Portuguese seem to use more vowel letters than do beginning spellers of English.

Our analysis may also explain the appearance of syllabic spellings, that is, spellings in which one letter is written for each syllable. Ferreiro and colleagues (Ferreiro & Teberosky, 1982; Tolchinsky, 2003; Vernon & Ferreiro, 1999) have emphasized the importance of using a procedure in which children are interviewed once their

spelling is completed so as to infer children's stage of spelling development. However, if a syllabic stage exists, it should also be observable in a more objective way in children's spelling, without the intervention of an experimenter. In Portuguese, we showed that two-syllable words have on average 1.7 letter names. Thus, if Portuguese-speaking children simply wrote down a letter whose name they hear in a word, they would produce nearly 1 letter (0.84) per syllable. We believe that children who write 0.84 letter per syllable would generally be accepted as being syllabic. At the same time, a pure letter name strategy would produce very different results for young speakers of English; they would produce only 0.33 letter per syllable by this strategy. Thus, a letter name strategy would lead Brazilian spellers to approximate 1 letter per syllable but would not lead U.S. spellers to any such approximation. The letter name hypothesis can account for putatively syllabic spellings in Portuguese as well as their general absence in English (Kamii et al., 1990; Martins & Silva, 2001; Sulzby, 1985), without any reference at all to syllables or syllable structure.

Our statistical analysis further implies that the letter name system of Portuguese could be more helpful to Brazilian children in their initial attempts to spell than could the letter name system of English. The fact that the name of a letter can be heard in most Portuguese words may make it easier for children to gain the insight that writing is a representation of sounds. After children have gained that insight, the fact that it can be applied on average two times per word may provide additional encouragement, as may the fact that teachers and caregivers are more likely to appreciate and praise spelling attempts where a couple of letters are reasonable representations of sounds in the word. On these points, English fails badly in comparison, at least with its traditional letter name system. These factors may help to explain early differences between speakers of English and those of other languages in terms of accuracy (e.g., Seymour et al., 2003, for reading). The low consistency between letters and sounds in English undoubtedly contributes to the relatively low performance of English speakers in literacy tasks, but the different properties of letter name systems may also contribute to higher performance in literacy in some languages than in others. This may be especially true early in literacy acquisition.

Study 2

Study 2 was designed to address experimentally how spelling of highly similar words differs between children in the United States and Brazil. We asked children to spell words matched on syllable length—two syllables—but varying in the number of vowel letter names they contain—one or two. Our first question was whether children in the two cultures indeed differ in their use of vowel letters. Based on the reports found in the literature, we would expect Portuguese-speaking children to produce more vowel spellings than English-speaking children, even on words of the same structure. A second question was whether Portuguese-speaking children show more evidence of syllabic spellings than do English-speaking children. Because all of our stimuli had two syllables, we expected Portuguese-speaking children to produce more two-letter spellings than English-speaking children. A third question was

whether speakers of the two languages are influenced by vowel letter names in their spelling. We expected children to use more vowels in the two-letter-name condition than in the one-letter-name condition. We also expected more phonologically plausible spellings in the two-letter-name condition than in the one-letter-name condition.

Method

Participants

Two groups of middle-class children participated. The first group consisted of 49 native speakers of Portuguese (24 boys and 25 girls) from Belo Horizonte, Brazil. Their ages ranged from 4 years 3 months to 6 years 5 months, with a mean of 5 years 6 months. The second group consisted of 43 native speakers of English (22 boys and 21 girls) from St. Louis, Missouri, in the United States. Their ages ranged from 4 years 8 months to 5 years 10 months, with a mean of 5 years 3 months. The age range in the Brazilian sample was wider than in the U.S. sample due to variations in when children enter preschool in the two countries. Both the U.S. and Brazilian children were recruited from private preschools during the middle of the school year. Preschools in both countries did not provide direct instruction in spelling but exposed children to the names and sounds of the letters of the alphabet, mostly in games and storytelling.

Stimuli

For the spelling task, in the two languages, we used two-syllable words that have a CVCV (consonant–vowel–consonant–vowel) structure. All words had stress on the first syllable. Only picturable words were chosen so that they could be presented along with color drawings to minimize memory load and make the task more enjoyable for the children. All of the words chosen were expected to be familiar to children but not to be among the words they would be able to spell at the beginning level.

The words were divided into two categories based on the number of letter names in the pronunciation of the words. The one-letter-name words, such as *bunny* /'bʌni/, ended in a vowel letter name (*E* /i/), whereas the two-letter-name words, such as *pony* /'poni/, had a vowel letter name in the first syllable as well (*O* /o/ and *E* /i/). We did not use words with no letter names because they are rare in Portuguese. None of the stimuli contained any consonant letter names (e.g., /bi/ in English) or consonants for which the typical spelling requires a digraph (e.g., /ʃ/, normally spelled *sh* in English). The stimuli were chosen so that the one- and two-letter-name stimuli had the same number of words with the same final vowel; for example, each group had the same number of words ending in /o/. The two groups were also balanced with respect to letter name patterns for the initial consonant; for example, each group had the same number of words whose first consonant's letter name began with /e/. No word had the same vowel sounds in the first and second syllables. All stimuli are listed in Table 4.

Table 4

Stimuli and letters considered to be plausible representations of sounds

One-letter-name stimuli						Two-letter-name stimuli					
Word	C1	V1	C2	V2	Word	C1	V1	C2	V2		
English											
<i>bully</i>	/'bʊli/	B	U/O	L	E/Y	<i>bony</i>	/'boni/	B	O	N	E/Y
<i>bummy</i>	/'bʌni/	B	U	N	E/Y	<i>goalie</i>	/'goli/	G	O	L	E/Y
<i>dolly</i>	/'doli/	D	O/A	L	E/Y	<i>holey</i>	/'holi/	H	O	L	E/Y
<i>gummy</i>	/'gʌmi/	G	U	M	E/Y	<i>Nike</i>	/'naiki/	N	I/Y	K	E/Y
<i>hippo</i>	/'hipo/	H	I	P	O	<i>phony</i>	/'foni/	F	O	N	E/Y
<i>holly</i>	/'hali/	H	O/A	L	E/Y	<i>pony</i>	/'poni/	P	O	N	E/Y
<i>limo</i>	/'limo/	L	I	M	O	<i>rainy</i>	/'ieni/	R	A	N	E/Y
<i>Mickey</i>	/'miki/	M	I	K	E/Y	<i>rhino</i>	/'rɪno/	R	I/Y	N	O
<i>rocky</i>	/'ɹaki/	R	O/A	K	E/Y	<i>silo</i>	/'sailo/	S	I/Y	L	O
<i>sunny</i>	/'sʌni/	S	U	N	E/Y	<i>tiny</i>	/'tɪni/	T	I/Y	N	E/Y
Portuguese											
<i>bolo</i>	/'bolu/	B	O	L	O/U	<i>bota</i>	/'bota/	B	O	T	A
<i>boto</i>	/'botu/	B	O	T	O/U	<i>bote</i>	/'boti/	B	O	T	E/I
<i>doce</i>	/'dosi/	D	O	S/C	E/I	<i>bule</i>	/'buli/	B	U	L	E/I
<i>fogo</i>	/'fogu/	F	O	G	O/U	<i>figo</i>	/'figu/	F	I	G	O/U
<i>gota</i>	/'gota/	G	O	T	A	<i>fila</i>	/'fila/	F	I	L	A
<i>mesa</i>	/'meza/	M	E	S/Z	A	<i>gado</i>	/'gadu/	G	A	D	O/U
<i>rede</i>	/'hedi/	R	E	D	E/I	<i>mula</i>	/'mula/	M	U	L	A
<i>remo</i>	/'hemu/	R	E	M	O/U	<i>ralo</i>	/'halu/	R	A	L	O/U
<i>rolo</i>	/'holu/	R	O	L	O/U	<i>rato</i>	/'hatu/	R	A	T	O/U
<i>sopa</i>	/'sopa/	S/C	O	P	A	<i>sapo</i>	/'sapu/	S/C	A	P	O/U

Procedure

All children were tested individually in a quiet room by an experimenter who was a native speaker of their language. Each child participated in three sessions on different days. For most children, the sessions were approximately 1 week apart. Five children participated in the two spelling sessions on the same day, with a break between the two tasks. The first session consisted of pretests evaluating the children's literacy level: a letter name task, a letter sound task, and a reading task (in that order). The spelling task was administered in the following two sessions.

Letter name task

Children were asked to identify letters of the alphabet. For this task, we used the same uppercase magnetic letters that would later be used in the spelling task. This set of letters comprised the letters necessary for spelling all of the sounds in the words given in the spelling task: 19 letters for the American children (*A, B, D, E, F, G, H, I, K, L, M, N, O, P, R, S, T, U, and Y*) and 17 letters for the Brazilian children (*A, B, C, D, E, F, G, I, L, M, O, P, R, S, T, U, and Z*). The letters were placed in front of the children, who were asked to choose the letter that corresponded to the name spoken by the experimenter. The letters were arranged and queried in a different random order for each child.

Letter sound task

This procedure was very similar to that of the letter name task, and the same letters were used. The set of letters was placed in front of the children, who were asked to choose the letter that spells the sound produced by the experimenter. The letter sounds were presented in random order. We tested the American children on the following sounds: /æ/, /ɑ/, /b/, /d/, /e/, /f/, /g/, /h/, /i/, /k/, /l/, /m/, /n/, /p/, /r/, /s/, /t/, /v/, and /ʌ/. The Brazilian participants were tested on the following sounds: /b/, /d/, /e/, /f/, /g/, /h/, /l/, /m/, /o/, /p/, /s/, /t/, and /z/. Those are the most common sounds of each of the letters given in the spelling task. We omitted testing for letter sounds that are identical to the letter names that were already covered in the preceding task.

Reading task

Children were given a word-and-picture reading task. We administered to the English-speaking sample the same task used by Treiman and Rodriguez (1999), and we adapted this task for the Portuguese-speaking participants using words of comparable difficulty and frequency: *alto* 'high', *amarelo* 'yellow', *azul* 'blue', *bola* 'ball', *chuva* 'rain', *comeu* 'ate', *em* 'in', *eu* 'I', *gato* 'cat', *joga* 'plays', *livro* 'book', *não* 'no', *nós* 'we', *olhe* 'look', *pula* 'jumps', *sou* 'am', *três* 'three', *um* 'one', *vai* 'goes', *vamos* 'let's go', *verde* 'green', and *você* 'you'. The experimenter showed children 11 different cards with two words and a picture, one card at a time, and asked them to identify any items that they knew. If children did not identify the items, the experimenter pointed to each item and asked whether the children knew it. The order of presentation of the cards was randomized for each child. The experimenter praised every response from the children. Children were scored only for their reading of the words; the pictures were included to make the task less frustrating for children who did not know how to read. All of the words were printed in uppercase letters and were frequent in kindergarten books of the respective countries.

Spelling task

Magnetic letters—the same letters presented in the letter name task—were placed in random order in front of the children on a magnetic board. The experimenter said a word while showing a picture representing the same object and then used the word in a sentence in a way that made reference to the picture. Then the experimenter said the word again and asked the children to repeat it and spell it. Magnetic letters were used to make the task easier for young children who did not yet know how to form letters with complete legibility and to avoid biasing results in favor of easy-to-draw letters. Children were told that the experimenter knew they did not know how to write yet, but the experimenter encouraged them to try their best. The experimenter praised every response. If children asked for a letter that did not belong to the initial set of magnetic letters or a letter that repeated a letter that had been used previously, the experimenter told them to try to spell the word with the letters provided. If children said that they could not spell the word without the letter, the experimenter provided the letter; this happened only rarely. The task was divided into two sessions of 10 words each to minimize effects of fatigue. The order of presentation of the words was randomized for each child.

Results

Table 5 shows the proportions of correct responses in the letter name, letter sound, and reading tasks. The results of these pretests are presented as proportions because different numbers of letters were tested in the two languages. Although most of the children could not read any words, they knew nearly all of the letter names and some letter sounds. The Brazilian and U.S. groups of children did not differ significantly in letter name knowledge, $t(90) = 0.57$, $p = .573$, letter sound knowledge, $t(90) = 0.36$, $p = .712$, or reading knowledge, $t(90) = 0.61$, $p = .544$.

The first analysis examined children's spellings in terms of the number of letters used, broken down by whether the letters were consonants or vowels. We counted *y* as a vowel for English because none of the words that was presented to children contained the consonantal sound of *y*, /j/, whereas several contained its main vocalic values, /i/ and /ai/. Note that 32% of the letters given to English-speaking children were vowels, whereas 29% of the letters given to Portuguese-speaking children were vowels. If this slight difference had any effect, we would expect it to lead to higher vowel use on the part of the English-speaking children.

Table 6 shows the results broken down by letter name count and language. We used a within-subject analysis of variance (ANOVA) with type of letter (consonant or vowel) and letter name count (one or two) as within-subject factors and language (Portuguese or English) as a between-subject factor in the by-subject analysis. In the by-item analysis, type of letter was a within-item factor and condition and language were between-item factors. The results showed a main effect of type of letter, by subject, $F(1, 90) = 37.64$, $p < .001$, and by item, $F(1, 36) = 419.80$, $p < .001$; children used more consonants than vowels. There was no main effect of letter name count; children did not differ in the total number of letters used in the two conditions. A main effect of language was found in the analysis by items, $F(1, 36) = 19.56$,

Table 5
Proportions of correct responses in pretests for Study 2

Pretest measure	Portuguese	English
Letter name task	.98 (.07)	.97 (.06)
Letter sound task	.72 (.26)	.70 (.20)
Reading task	.17 (.28)	.20 (.26)

Note. Standard deviations are in parentheses.

Table 6
Mean numbers of letters used to spell words in each condition in Study 2

Letter name count	Portuguese			English		
	Vowel	Consonant	Total	Vowel	Consonant	Total
One letter name	1.69 (0.41)	2.32 (0.94)	4.01 (1.01)	1.42 (0.65)	2.30 (1.20)	3.72 (1.70)
Two letter names	1.90 (0.33)	2.11 (0.86)	4.02 (1.01)	1.58 (0.57)	2.21 (1.37)	3.79 (1.77)
All stimuli	1.79 (0.32)	2.22 (0.87)	4.02 (0.98)	1.50 (0.59)	2.25 (1.26)	3.75 (1.73)

Note. Standard deviations are in parentheses.

$p < .001$, but not in the analysis by subjects, $F(1,90) = 0.773$, $p = .382$; Portuguese-speaking children tended to use more letters to spell the words, but this was probably not a reliable difference. There was an interaction between type of letter and letter name count, by subject, $F(1,90) = 29.05$, $p < .001$, and by item, $F(1,36) = 34.39$, $p < .001$. This interaction reflects the fact that children used more vowels to spell words that contained letter names for each of the vowels, but no difference was found in the use of consonants in the two conditions. An interaction between type of letter and language was significant in the by-item analysis, $F(1,36) = 34.84$, $p < .001$, and marginally significant in the by-subject analysis, $F(1,90) = 3.12$, $p = .081$. This interaction shows that Brazilian children used significantly more vowels than did U.S. children but that the two groups of children did not differ significantly in their use of consonants. No other effects were found.

To verify whether children had a tendency to misspell vowel letter name sounds with the corresponding vowel letters, we performed a post hoc analysis of errors made in spelling the last sounds in the stimuli, which were letter name sounds in all cases. We excluded the 10 stimuli in which the correct spelling would be the vowel letter in question. In Portuguese the remaining words ended with either /i/ or /u/, whereas in English all of the words ended with /i/. We examined all spellings that ended in an incorrect vowel letter. The use of a letter name was the single most common mistake in both language groups. Children used the named vowel letter in 69% of the misspellings in English and in 70% of the misspellings in Portuguese.

Next we analyzed whether the first letter of each spelling was a consonant or a vowel. We focused on the first letter because the beginning of words is typically highly salient, especially in our stimuli that had stress on the initial syllable. An initial vowel spelling implies that children found the first vowel important, omitting the consonant that began all of our stimuli. Portuguese speakers used a vowel letter in the first position of the word in 17.5% of their spellings, whereas English speakers did so in only 5.9% of their spellings. To analyze these data, we used a within-subject ANOVA with letter name count as a within-subject factor and language as a between-subject factor. In the item analysis, we used an ANOVA with letter name count and language as between-item factors and percentage of vowels used in the first position as the dependent variable. Only the main effect of language was significant, by subjects, $F(1,90) = 8.622$, $p = .004$, and by items, $F(1,36) = 68.38$, $p < .001$.

The use of two letters to represent the words was not very frequent. Two-letter spellings were produced 10% of the time by the Brazilian children and 19% of the time by the U.S. children. Only 3 children in each language group produced 80% or more two-letter spellings.

Finally, we categorized the letters in children's spellings as plausible or not. Plausible letters were letters that represent the phonemes in ordinary words in the language in question. Table 4 shows which letters we considered plausible for each sound. The vowels /i/ and /u/ in Portuguese can be spelled either *e* or *i* and *o* or *u*, respectively, and so either letter was counted as correct for the second vowel of the word. However, for the purposes of this study, we considered only *i* and *u* as plausible spellings for /i/ and /u/ in the middle position of the words because other-

Table 7

Proportions of plausible representations of consonants and vowels in Study 2

Type of phoneme	Portuguese			English		
	One letter name	Two letter names	All	One letter name	Two letter names	All
Consonant	.61 (.30)	.65 (.30)	.63 (.30)	.66 (.27)	.68 (.26)	.67 (.26)
Vowel	.71 (.26)	.83 (.21)	.77 (.22)	.49 (.23)	.57 (.23)	.53 (.22)
Any	.66 (.26)	.74 (.23)	.70 (.24)	.58 (.21)	.63 (.21)	.60 (.21)

Note. Standard deviations are in parentheses.

wise our plausibility count would have created an advantage in support of our hypothesis (i.e., that children will show more plausible spellings of vowels in the two-letter name condition and in Portuguese). For each trial, we counted the number of vowel sounds (of a possible two) in the stimulus that had a plausible corresponding letter in the children's spelling, and we did the same for the two consonants in each word. Table 7 reports these as proportions, broken down by language and the number of letter names in the words. We used a within-subject ANOVA with letter name count and type of letter (consonant or vowel) as a within-subject factor and language as a between-subject factor in the by-subject analysis of these data. In the by-item analysis, type of letter was a within-item factor and language and letter name count were between-item factors. We found a main effect of letter name count, by subjects, $F(1,90) = 41.20$, $p < .001$, and by items, $F(1,36) = 24.70$, $p < .001$, such that children used more plausible spellings for words that had two letter names. There was also a main effect of language, by subjects, $F(1,90) = 4.52$, $p = .036$, and by items, $F(1,36) = 66.00$, $p < .001$, meaning that Portuguese speakers made more plausible spellings than did English speakers. We found an interaction between type of letter and letter name count, by subjects, $F(1,90) = 11.10$, $p < .001$, and by items, $F(1,36) = 9.72$, $p = .032$, such that children did better on vowels in words with two letter names. This difference was not found with the consonants. An interaction between type of letter and language was also found, by subjects, $F(1,90) = 38.78$, $p < .001$, and by items, $F(1,36) = 154.20$, $p < .001$, reflecting the fact that English-speaking children did better with consonants than with vowels, whereas Portuguese-speaking children showed the reverse pattern.

Discussion

Study 2 was designed to investigate whether English- and Portuguese-speaking children differ in their spellings of words that are substantially equated across languages. A first question was whether children from the two cultures really differ in whether they favor vowel or consonant letters when the number of consonant and vowel sounds is controlled. We found that the Brazilian children used more vowel letters than did the U.S. children. It was particularly striking that the Brazilian children were three times more likely to start a word with a vowel letter than were the U.S. children. This difference cannot be explained by the stimuli used in the

experiment because they all had the same number of vowel and consonant sounds. However, the difference may be explained by the differing properties of the writing systems to which the children have been exposed. As found in Study 1, children learning to spell in Portuguese have been exposed to printed words that have a vowel-to-consonant ratio of nearly one to one. That could explain the fact that Portuguese-speaking children used vowels much more frequently than did English-speaking children. Children who see written Portuguese may pick up on the fact that words have a high proportion of vowel letters in them. Conceivably, the preponderance of vowels disproportionately attunes children to attend to vowels in spelling. Taken together, this evidence provides an explanation for reports in the literature of all-vowel spellings by Portuguese-speaking children and of consonant spellings by English-speaking children (e.g., Kamii et al., 1990; Nunes Carraher & Rego, 1984).

A second question was whether children from the two cultures differ in their use of syllabic spellings. The literature (e.g., Ferreiro & Teberosky, 1982) makes very frequent reference to syllabic spellings among Romance language-speaking children in the age group under consideration, but evidence for this in our data is scant. Because all of our stimuli had two syllables, syllabic spellers would be expected to produce two-letter spellings in all responses. But only a small fraction of the spellings were two letters in length (10% of the Portuguese spellings), and contrary to all expectations, such spellings were nearly twice as common in English. Altogether, there is only weak evidence for a syllabic stage of development and certainly no evidence that Portuguese speakers evince this tendency more than do English speakers.

A third issue addressed by Study 2 was whether children are influenced by letter names in their spelling. All of our analyses showed that the answer to this question is affirmative. In both English and Portuguese, the presence of vowel letter names in the words led children to use more vowels in their spellings. Our post hoc analysis of vowel spelling errors at the end of words also showed heavy use of letters for their letter name value, as when children spelled *pony* with a final *E*. Use of a letter name strategy is very plausibly a major contributor to that effect. Letter names also made spellings more phonologically accurate. This accords with previous findings (Cardoso-Martins & Batista, 2003; Martins & Silva, 2001) that Portuguese-speaking children are more likely to spell a phoneme with a phonetically plausible letter when that phoneme constitutes the letter's name. Our results show that vowel letter names do influence children's spelling, eliciting both more vowel spellings and more accurate phonological spellings of the stimuli.

General discussion

Previous studies have suggested some potentially important differences between speakers of Romance languages and speakers of English in how they approach the task of learning to spell. In particular, speakers of Romance languages appear to use more vowels and have been reported to spell syllabically, writing one symbol per syllable. Given the impact that such differences may have on theories of spelling

acquisition (e.g., whether children pass through a syllabic stage of development) and on the teaching of literacy, it is important to study them quantitatively.

We found some statistically significant differences in the spelling productions of Brazilian and U.S. children, but these are not of the magnitude that would suggest categorical differences in how children approach spelling in the different countries. Instead of great categorical differences between children's spellings in the two languages, we found small but significant quantitative differences. We believe that they are the sorts of differences best accounted for by graded differences in environmental input rather than by large qualitative differences between the languages. One quantitative difference in the input is that Portuguese words have more vowels than do English words, as documented in Study 1. Given this, it should not be surprising to see more vowels in the spontaneous spellings of Portuguese speakers, as we did in Study 2. Even when the words that English and Portuguese children are asked to spell contain an identical number of vowels, as was the case in that study, the relative preponderance of vowels in Portuguese vocabulary as a whole seems to exert a small but measurable indirect influence. When young spellers are uncertain as to which letter to use, their last resort may well be to fall back on familiarity. Assuming that they have seen substantial amounts of text in their environment—as is nearly certain for middle-class children—young children may favor letters that they have seen more often. Because vowel letters are disproportionately more common in Portuguese text than in English text, Brazilian children would be more likely to select a vowel letter than would U.S. children.

A letter name spelling strategy may also contribute to the greater number of vowel letters in early Portuguese spelling than in early English spelling. Study 2 documented that children are more likely to insert a vowel letter in their spelling if they hear its letter name in a word. Although the magnitude of that letter name effect is not significantly greater per se in Portuguese than in English, one must consider an interaction with the vocabulary of the respective languages. Children's vocabulary in Portuguese contains more than four times the number of vowel letter names per word. Therefore, a letter name effect will lead to proportionately more vowel spellings in Portuguese than in English when spelling words that are typical of the respective languages.

The differences that we have documented between Portuguese and English in frequency of vowel letters and letter names could lead to spellings that appear to support the idea of a syllabic stage for Portuguese. Spellings such as *UUU* for *urubu* are often reported as demonstrations of syllabic spellings (Nunes Carraher & Rego, 1984) in that children represented each syllable with one letter. However, we have shown that children are more likely to spell a letter when its name appears in a word. Children who rely on that strategy to any great extent should show a strong tendency to spell vowels and omit consonants in Portuguese. The effect would presumably be stronger in Spanish and in most accents of Italian, where every vowel sound is also a letter name. The end result of such a letter name strategy—spelling letters whose names are heard in words, that is, mostly just the vowel of each syllable—is indistinguishable or easily confounded with a syllabic spelling strategy—writing a single symbol to characterize each syllable. With the syllabic spelling hypothesis, however,

it is difficult to explain why examples of syllabic spellings almost invariably consist of strings of vowel letters to the exclusion of consonant letters. Why should a consonant letter be less capable than a vowel letter of representing a syllable in children's minds? Our alternative hypothesis—that the apparent syllabic spellings in Portuguese and other languages actually reflect use of letter names—explains this phenomenon. Spellings that contain a large number of vowels can easily be accounted for by the letter name spelling strategy, which is already required to account for other documented phenomena. Thus, we question the need for the complicating assumption of a syllabic spelling stage, an assumption that is generally held among researchers studying Romance languages and that is applied by preschool educators in many Latin American and European countries (e.g., Martins & Silva, 2001).

Finally, our results may have a bearing on why English-speaking children often perform relatively poorly in literacy tasks. Cross-linguistic studies (Aro & Wimmer, 2003; Defior et al., 2002; Seymour et al., 2003) have emphasized letter–sound consistency as the major factor. Although this is undoubtedly true across the spellers' life spans, we believe that other factors may be rather important as children just begin to learn how to write. At early ages, it is more appropriate to hope for phonetically plausible spellings than for conventionally perfect ones, and so consistency in the standard orthography is not really a relevant measure. Our data show that English-speaking children produce more plausible spellings for consonants than for vowels, whereas Portuguese-speaking children show the reverse pattern. We propose that, at least for young children, those differences could be explained not only by consistency but also by other statistical properties that vary across languages, especially the letter name system and its interaction with children's vocabularies. Admittedly, the differences uncovered in our study are of small magnitude. However, considering that children in the current study were very young, leading to random noise in the data, and that the words presented to the two language groups were controlled for number of letter names, we believe that the numbers are important indicators of language differences. These differences would likely be boosted in a naturalistic setting, where Portuguese-speaking children will encounter many more words that contain vowel letter names than will English-speaking children. The fact that children can profit from a letter name strategy more often in Portuguese than in English, especially with respect to vowels, may exert a strong influence on young spellers, leading to greater overall reliance on and more plausible production of vowels in Portuguese-speaking children.

Cross-cultural studies are important for determining how specific properties of a language can make easier or harder the task of children who are trying to read and spell. The studies reported in this article have quantified differences between the writing systems of English and Portuguese, expanding previous work by analyzing aspects of the language that have been neglected by past cross-linguistic studies: letter names and letter patterns. Our results demonstrate how those differences may lead to different patterns in performance of children acquiring spelling in those writing systems and may shed doubt on the commonly accepted view that learners of Portuguese and other Romance languages go through a syllabic stage in the development of spelling.

Acknowledgments

This work was supported in part by a grant (BCS-0130763) from the National Science Foundation. We thank Cláudia Cardoso-Martins and Mirelle França Michalick for their help with the Brazilian part of the study, and we thank Annukka Lehtonen, Amanda Mount, Sabria McElroy, and Angela Wong for helping with the American part of the study. We are also grateful to the faculty, parents, and children from the schools that participated in the study: Colégio Marista Dom Silvério, Forsyth School, and Wilson School.

References

- Aro, M., & Wimmer, H. (2003). Learning to read: English in comparison to six more regular orthographies. *Applied Psycholinguistics*, *24*, 621–635.
- Blevins, J. (1995). The syllable in phonological theory. In J. A. Goldsmith (Ed.), *The handbook of phonological theory* (pp. 206–244). Cambridge, MA: Blackwell.
- Cardoso-Martins, C., & Batista, A. C. E. (2003, April). *The role of letter name knowledge in learning to connect print to speech: Evidence from Brazilian Portuguese-speaking children*. Paper presented at the meeting of the Society for Research in Child Development, Tampa, FL.
- Cardoso-Martins, C., Resende, S. M., & Rodrigues, L. A. (2002). Letter name knowledge and the ability to learn to read by processing letter–phoneme relations in words: Evidence from Brazilian Portuguese-speaking children. *Reading and Writing*, *15*, 409–432.
- CMU pronouncing dictionary (version 0.6) [data file] (1998). Carnegie Mellon University, Speech at CMU Web site <ftp://ftp.cs.cmu.edu/project/speech/dict/cmudict.0.6>.
- Defior, S., Martos, F., & Cary, L. (2002). Differences in reading acquisition development in shallow orthographies: Portuguese and Spanish. *Applied Psycholinguistics*, *23*, 135–148.
- Ferreiro, E. (1990). Literacy development: Psychogenesis. In Y. Goodman (Ed.), *How children construct literacy: Piagetian perspectives* (pp. 12–25). Newark, DE: International Reading Association.
- Ferreiro, E., & Teberosky, A. (1982). *Literacy before schooling*. New York: Heinemann.
- Frith, U. (1985). Beneath the surface of developmental dyslexia. In K. E. Patterson, J. C. Marshall, & M. Coltheart (Eds.), *Surface dyslexia: Neuropsychological and cognitive studies of phonological reading* (pp. 301–330). Hillsdale, NJ: Lawrence Erlbaum.
- International Phonetic Association. (1999). *Handbook of the International Phonetic Association: A guide to the use of the International Phonetic Alphabet*. Cambridge, UK: Cambridge University Press.
- Kamii, C., Long, R., Manning, M., & Manning, G. (1990). Spelling in kindergarten: A constructivist analysis comparing Spanish-speaking and English-speaking children. *Journal of Research in Childhood Education*, *4*, 91–97.
- Kessler, B., & Treiman, R. (2001). Relationships between sounds and letters in English monosyllables. *Journal of Memory and Language*, *44*, 592–617.
- Levin, I., Patel, S., Margalit, T., & Barad, N. (2002). Letter names: Effect on letter saying, spelling, and word recognition in Hebrew. *Applied Psycholinguistics*, *23*, 269–300.
- Levin, I., Share, D. L., & Shatil, E. (1996). A qualitative–quantitative study of preschool writing: Its development and contribution to school literacy. In C. M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 271–293). Mahwah, NJ: Lawrence Erlbaum.
- Liberman, I. Y., Shankweiler, D., Fischer, F. W., & Carter, B. (1974). Explicit syllable and phoneme segmentation in the young children. *Journal of Experimental Child Psychology*, *18*, 201–212.
- Martins, M. A., & Silva, C. (2001). Letter names, phonological awareness, and the phonetization of writing. *European Journal of Psychology of Education*, *4*, 605–617.
- Mills, L. (1998). Syllabic stage of English speaking preschoolers. *Reading Research and Instruction*, *37*, 297–317.

- Nunes Carraher, T., & Rego, L. R. B. (1984). Desenvolvimento cognitivo e alfabetização. *Revista Brasileira de Estudos Pedagógicos*, 63, 38–55.
- Pike, K. L. (1945). *The intonation of American English*. Ann Arbor: University of Michigan Press.
- Pinheiro, A. M. V. (1996). *Contagem de frequência de ocorrência de palavras expostas a crianças na faixa pré-escolar e séries iniciais do 1º grau*. São Paulo, Brazil: Associação Brasileira de Dislexia.
- Pontecorvo, C., & Zuccheromaglio, C. (1988). Modes of differentiation in children's writing construction. *European Journal of Psychology of Education*, 3, 371–384.
- Read, C. (1986). *Children's creative spelling*. London: Routledge & Kegan Paul.
- Seymour, P. H. K., Aro, M., & Erskine, J. M. (2003). Foundation literacy acquisition in European languages. *British Journal of Psychology*, 94, 143–175.
- Silva, C., & Alves-Martins, M. (2002). Phonological skills and writing of pre-syllabic children. *Reading Research Quarterly*, 37, 466–483.
- Sulzby, E. (1985). Kindergartners as writers and readers. In M. Farr (Ed.), *Advances in writing research, Vol. 1: Children's early writing development* (pp. 127–199). Norwood, NJ: Ablex.
- Tolchinsky, L. (2003). *The cradle of culture and what children know about writing and numbers before being taught*. Mahwah, NJ: Lawrence Erlbaum.
- Tolchinsky, L., & Teberosky, A. (1998). The development of word segmentation and writing in two scripts. *Cognitive Development*, 13, 1–24.
- Treiman, R. (1993). *Beginning to spell: A study of first-grade children*. New York: Oxford University Press.
- Treiman, R. (1994). Use of consonant letter names in beginning spelling. *Developmental Psychology*, 30, 567–580.
- Treiman, R., & Kessler, B. (2003). The role of letter names in the acquisition of literacy. In R. Kail (Ed.), *Advances in child development and behavior* (Vol. 31, pp. 105–135). San Diego: Academic Press.
- Treiman, R., & Rodriguez, K. (1999). Young children use letter names in learning to read words. *Psychological Science*, 10, 334–338.
- Treiman, R., & Zukowski, A. (1996). Children's sensitivity to syllables, onsets, rimes, and phonemes. *Journal of Experimental Child Psychology*, 61, 193–215.
- Varnhagen, C. K., Boechler, P. M., & Steffler, D. J. (1999). Phonological and orthographic influences on children's vowel spelling. *Scientific Studies of Reading*, 4, 363–379.
- Vernon, S. A., & Ferreiro, E. (1999). Writing development: A neglected variable in the consideration of phonological awareness. *Harvard Educational Review*, 69, 395–414.
- Zeno, S. M., Ivens, S. H., Millard, R. T., & Duvvuri, R. (1995). *The educator's word frequency guide*. Brewster, NY: Touchstone Applied Science Associates.