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The literate listener: Effects of spelling on syllable judgments

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ABSTRACT

We investigated the effects of spelling knowledge on the representation of spoken language. In the experiment, subjects first saw the written form of a nonsense word, then heard it and judged the number of syllables. For the identical acoustic tokens, the number of judged syllables varied with the accompanying spelling. The effect of spelling was stronger for one syllable pronunciations than for two syllable pronunciations. The results are discussed in relation to the role of spelling knowledge in listeners' representations of phonology.

INTRODUCTION

The alphabetic principle of our writing system links the written and spoken forms of words. Awareness of the phonological structure of speech has been shown to play an important role in learning to read and write (e.g., Treiman & Baron, 1981). We were concerned with influences in the opposite direction; that is, with effects of orthographic knowledge on listeners' notions of words' phonological forms. Specifically, we asked whether the number of syllables people think a spoken word contains depends on how they think the word is spelled.

Some evidence that knowledge of an alphabetic writing system shapes one's conception of spoken language was provided by Morais, Carey, Bertelson, and Alegria (1980). These researchers compared literate and illiterate adults on their ability to segment spoken words into phonemes. Morais et al. had their subjects add or delete phonemes from words and nonwords. They found that the illiterate adults had difficulty in manipulating phoneme-sized units. Morais et al. concluded that learning to read is important for the ability to think of speech as composed of separate units.

Further evidence that knowledge of spelling shapes one's conception of the component sounds of a word was provided by Ehri and Wilce (1980). Ehri and Wilce had fourth grade children count the sounds in familiar words. They compared pairs like rich and pitch which have equivalent pronunciations, but different spellings. Ehri and Wilce found that the children counted more sounds in the words with more letters in their spelling. Since children may have had different mental representations of the pronunciations of these existing words, Ehri and Wilce conducted a second study in which they taught children spellings for novel words. For example, children were taught either ZICH or ZITCH. In a subsequent session, they counted the sounds in the novel words. Again, children counted more sounds in the words with extra letters.

Knowledge of the spelling of a word influenced children's judgments of how many sounds the spoken form contained, both for preexisting spellings and newly learned ones.

These demonstrations of an influence of spelling on mental representations of phonology have dealt with early developmental influences. We sought to demonstrate such an influence in adult listeners. We all continue to learn new words and must represent their phonological properties. Does knowledge of spelling influence these representations, and in what way? In our experiment, we varied both the pronunciation of the new words and their spelling. We presented the written forms first.

Instead of looking at judgments of the phonemic structure of novel spoken words, we looked at judgments regarding syllabic structure. The spelling of a word conveys information about several levels of linguistic structure, including syllable composition. Compare the two spellings FLOUR and FLOWER. We have the intuition that the former is a one syllable word and the latter a two syllable word, even though they can be pronounced identically.

METHOD

Materials and Design

The critical items were 16 pairs of nonwords. The nonwords were based on pairs of real words like rule - jewel and owl - towel. Nonwords were constructed by combining the rhyme portions of the words with new onsets (i.e., single consonants and clusters). Two nonword pairs were formed from each word pair. For example, rowl - rowel and spowl - spowel were formed from owl - towel. The first members of the pairs have "one syllable spellings" and the second have "two syllable spellings." Thus, each nonword pair represents two possible pronunciations and two possible spellings.

In addition, there were 10 one syllable fillers (e.g., blee), 8 two syllable fillers (e.g., tarrid), and 16 three syllable fillers (e.g., repliment).

Two lists were constructed from these stimuli. Each list contained 16 critical nonwords and 34 fillers. The lists were constructed such that one member of each critical pair occurred on each list. For example, rowl and spowel occurred on one list, and rowel and spowl on the other. The 50 nonwords were grouped into 10 sets of 5 items each.

The lists of nonwords were recorded by the first author. The speaker attempted to pronounce each critical item in accordance with its spelling on a given list. Each trial began with the word "ready", then after a 3 to 4 second pause the nonword was pronounced. About one second later, the speaker said "turn the page" and there was a 5 second pause before the next "ready." This sequence was repeated for five items. After the last item in a set, the speaker said "Now recall the words in any order." There was a 30 second silent period on the tape. Each tape began with a practice set of five real

words.

The taperecorded materials were accompanied by booklets of written materials. The booklets contained the written forms of the nonwords, typed in large capital letters in the center of a page, followed by answer sheets for the syllable counting task. Following the answer sheet for the fifth item in each set was a sheet with five recall clues, consisting of the first consonant or consonants of the nonwords. At the beginning of each set of five items, there was a sheet with the instruction "Turn this page when you hear ready."

There were two versions of the written materials, with the one syllable spelling in one version, and the two syllable spelling in the other. For example, ROWL and SPOWEL appeared in one version; ROWEL and SPOWL appeared in the other.

Each tape was paired with each version of the written materials. Thus, the written form of each critical item was either the same as its pronunciation on a given tape (match), or was the alternate spelling (mismatch). Four groups of listeners received the four combinations of recorded and written materials, so that the spelling manipulation was between subjects.

Procedure

Subjects were tested individually in a sound-treated room. They were told that the experiment investigated how people remember new words, and that they would see and hear nonsense words and then recall them. At the beginning of each set of five, subjects waited for the word "ready," and then turned the cover sheet to see the first printed nonsense word. They then heard the item pronounced. Then they turned the page, and had 5 seconds to mark the number of syllables. When they finished, they turned to the next printed nonsense word. In this way, subjects viewed the printed form of the nonsense word for several seconds before they heard it spoken. After marking the number of syllables in the fifth item in each set, subjects recalled the last five items, into the microphone, using the clues provided in the booklet. After 30 seconds, they went on to the next set.

Subjects

Forty undergraduates at the University of Wisconsin-Madison participated for course credit or for payment. All were native speakers of English.

Spelling and Pronunciation Judgments

Two additional sets of judgments were collected from other subjects. One group of forty subjects only saw the spellings of the nonsense words, and indicated how many syllables each had. A second group only heard the taperecorded nonsense words (re-recorded from the tape used in the main experiment), and judged the number of syllables.

RESULTS

Only the results from the syllable judgment task are reported here. The recall results will be presented in a later report.

Subjects' responses were scored as consistent or inconsistent with the intended number of syllables in the pronunciation. For the fillers, there were only 9 disagreements (out of 1360 responses) with the intended number of syllables. For the critical items, all but one of the inconsistent responses corresponded to the other (one or two) possible number of syllables.

Table 1 presents the percentage of responses consistent with the pronunciations of the nonsense words. When the number of syllables in the spelling matched the pronunciation, 84% of the responses agreed with the intended number of syllables. When the spellings and pronunciations mismatched, only 31% agreed with the pronunciation. The effect of spelling on syllable judgments was much stronger for one syllable pronunciations than for two syllable pronunciations. When a two syllable spelling accompanied a one syllable pronunciation, subjects generally judged that the word contained two syllables. When a one syllable spelling accompanied a two syllable pronunciation, one and two syllable judgments were about equally common.

These patterns were supported by statistical tests across subjects and items. The effect of spelling was highly significant in the subjects analysis, $F(1,38) = 127.94$, $p < .001$, and in the items analysis, $F(1,30) = 304.85$, $p < .001$; min $F'(1,63) = 90.12$, $p < .001$. The interaction between spelling and pronunciation was significant in both the subjects ($F(1,38) = 7.49$, $p < .01$) and items ($F(1,30) = 24.30$, $p < .001$) analyses; min $F'(1,58) = 5.73$, $p < .05$.

TABLE 1
Percent of responses consistent with pronunciation

	Spelling	
	Match	Mismatch
Pronunciation		
One Syllable	79	11
Two Syllable	89	51

TABLE 2
Percent agreement with intended number of syllables

One Syllable Spelling   86
Two Syllable Spelling   90

One Syllable Pronunciation   70
Two Syllable Pronunciation   70

Table 2 presents the agreement between subjects' judgments and the intended number of syllables for the written and spoken forms alone. Syllable judgments based solely on the spellings of the nonsense words agreed with our intentions almost 90% of the time. The amount of agreement was essentially equivalent for the one and two syllable spellings. Syllable judgments based solely on hearing the nonsense words agreed with our intentions 70% of the time. Although there was less agreement with regard to pronunciations than with regard to spellings, the attempts at one and two syllable pronunciations were equally successful.

DISCUSSION

When adult listeners counted syllables in a novel spoken word, the number depended on the spelling they had just read. To take a particular instance, the one syllable pronunciation of "shule" was judged as monosyllabic by 95% of listeners who only heard it. With the spelling SHULE, 9 out of 10 listeners judged it as having one syllable. With the spelling SHEWEL, 8 out of 10 listeners judged it as having two syllables. The tendency of our adult listeners to count extra syllables in accord with the spellings of novel words is similar to Ehri and Wilce's (1980) finding that children counted extra sounds in words with additional letters.

On what were our subjects' syllable judgments based? The presence of an interaction between spelling and pronunciation suggests that both spelling and pronunciation were used. Before elaborating on this aspect of the results, two uninteresting interpretations of the interaction must be ruled out. If we consider the judgments based on pronunciation alone, we cannot attribute the interaction between spelling and pronunciation to greater ambiguity in the number of syllables in one syllable pronunciations. The one and two syllable pronunciations were comparable in terms of agreement on the number of syllables. Neither can the interaction be attributed to weaker bias of the one syllable spellings. Overall, the alternative spellings were equally strongly biased for the intended number of syllables.

The greater power of spelling over one syllable pronunciations than over two syllable pronunciations can be interpreted by postulating a distinction between a word's actual pronunciation and its "ideal" or canonical pronunciation. A listener's notion of a word's ideal pronunciation is affected by the word's spelling as well as by its phonological and morphological structure. We further postulate that ideal pronunciations tend

to be more complex and differentiated than actual pronunciations. It is natural for listeners to set up a two syllable ideal pronunciation (e.g., "shewel") when they only hear one syllable ("shule"); it is less natural for them to set up a one syllable ideal when they hear two syllables. This asymmetry reflects the fact that polysyllabic words are often shortened (e.g., "general" becomes "gen'ral"), while it is less common for syllables to be added. Thus, listeners were more willing to insert an unheard syllable based on the spelling, than to ignore a heard syllable.

Further support for the distinction between actual and ideal pronunciations, and for the idea that ideal pronunciations are more differentiated than real pronunciations, comes from a study by Taft and Hambly (1985). These researchers asked subjects to monitor known words for targets presented auditorily. According to linguists' phonemic analyses, "safari" begins with /səf/, but the majority of Taft and Hambly's literate listeners took it to begin with /sæf/. Taft and Hambly concluded that orthography influences the mental representations of words. Their listeners may be said to have thought that "safari" <u>really</u> contains an unreduced vowel, regardless of the acoustic-phonetic information that is usually present. The ideal representation differs, in this case, from the phonemic representation. It may be considered a <u>meta</u>phonological representation -- a representation whose units are available to conscious awareness and manipulation.

Cowan, Braine, and Leavitt (1985) provide some further data on the nature of metaphonological representations. They studied people who "talk backward," reversing the order of units in words. Some subjects reversed the spellings of words, others reversed sounds. But even subjects who manipulated sounds re-ordered units which were defined by orthography. For example, the consonant cluster /ks/ was treated as a unit only when it was spelled with an X. Cowan et al. argue that knowledge of spelling acts as an important source of constraint in the development of metaphonological knowledge.

Our results support this claim and, together with other recent findings (Donnenwerth-Nolan, Tanenhaus, & Seidenberg, 1981; Jakimik, Cole, & Rudnicky, 1985; Seidenberg & Tanenhaus, 1979), imply a very tight connection between the written and spoken forms of words. Orthographic knowledge, it appears, influences performance in a variety of tasks that do not logically require it.

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