

Misreadings by beginning readers of Serbo-Croatian

VESNA OGNJENović*, G. LUKATELA*, LAURIE B. FELDMAN†
AND M. T. TURVEY†

* *University of Belgrade, Yugoslavia, and † Haskins Laboratories
and University of Connecticut, USA*

Errors in reading aloud by the beginning reader have been interpreted as reflecting the difficulty and the importance of phonemic segmentation for the acquisition of reading skills. Results from previous studies on English words patterned as consonant-vowel-consonant showed: (1) more errors on vowels than on consonants; (2) more errors on word final consonants than on word initial consonants; and suggested that (3) consonant errors were based on phonetic confusions while vowel errors were not. In contrast to their English counterparts, the beginning readers of Serbo-Croatian tested in the present study committed proportionally fewer errors on their reading of vowels than of consonants but in common with their English counterparts, their reading of final consonants was more vulnerable to error than their reading of initial consonants. This pattern of errors was found for both word and pseudoword consonant-vowel-consonant structures and the pattern of vowel confusion, like the pattern of consonant confusions, was rationalized by speech-related factors. The differences between the patterns of confusions for Serbo-Croatian and for English could be due to the difference between the two orthographies in the precision with which they represent the phonology or to the fact that the vowels of English are qualitatively less distinct phonologically than the vowels of Serbo-Croatian.

For any alphabetic orthography the highly encoded nature of phonemes in the spoken language bears significantly on the task of learning to read analytically—that is, learning to relate to letter strings in a way that efficiently exploits the specification of a letter string's pronunciation by its spelling. The significance of speech encodedness to reading has been extensively discussed by Gleitman and Rozin (1977) and it has shaped the orientation of the Haskins Laboratories group to the task that befalls the beginning reader (Liberman, 1971, 1973; Fowler, Liberman and Shankweiler, 1977; Mattingly, 1972; Shankweiler and Liberman, 1972; Shankweiler, Liberman, Mark, Fowler and Fischer, 1979). To read analytically the child must explicitly realize that continuous speech is divisible into phonemes and that each word is decomposable into a specific number of phonemes ordered in a specific way. This explicit realization—"linguistic awareness" (Mattingly, 1972)—is made difficult, it is argued, by the fact that the phonemes are not represented in the speech stream as discrete, isolable entities but rather they are encoded into the structure of the syllable (Liberman, Cooper, Shankweiler and Studdert-Kennedy, 1967; Liberman, Mattingly and Turvey, 1972). In contrast to speech perception, reading entails a more deliberate

appreciation of component structure. The word *bat* is comprised of three phonetic segments, yet acoustically there are no distinct segments. The child's putative difficulty, it should be emphasized, is not with differentiating minimally contrastive word pairs—such as *bad* and *bat*—but rather with appreciating that each word is decomposable into three segments, the first two of which are shared by the two words and the third of which distinguishes them (Lieberman and Shankweiler, 1977).

There is considerable evidence that young children have difficulty segmenting the spoken word (see Gleitman and Rozin, 1977; and Liberman and Shankweiler, 1978, for a review). It has been proposed that this difficulty is reflected in the pattern of errors a child produces in reading. Shankweiler and Liberman (1972) had third grade American children read aloud consonant-vowel-consonant letter strings, all of which were words. They observed that errors on the final consonants were far more numerous than errors on the initial consonants; in addition, they observed that errors on the medial vowels far exceeded those on consonants in both final and initial position. Similar error patterns had been noted in earlier reports (Daniels and Diack, 1956; Venezky, 1968; Wheeler, 1970). Shankweiler and Liberman (1972) proposed two interpretations. According to the first interpretation, the error pattern reflects the beginning reader's differential difficulty in segmenting sounds occurring in the initial, medial and final positions in the syllable. That is to say, the error difference between the initial consonants, medial vowels and final consonants is attributed to the relative positions within the syllable occupied by the different types of sound and not to differences among the sound-types themselves. According to this first interpretation, the higher error rate for the medial vowels than for the initial and final consonants is because the individual vowel is spread throughout the syllable. Other speech-related arguments for the greater susceptibility of medial vowels to be read incorrectly can be cited. Generally, there is reason to suppose that the properties of vowels in speech as distinguished from the properties of consonants may have perceptual consequences (Lieberman, Cooper, Shankweiler and Studdert-Kennedy, 1967; Liberman, Mattingly and Turvey, 1972). The categorical perception that marks the (stop) consonants is less obviously characteristic of vowel perception. In addition, the contribution of the consonants to the phonological message is not matched by the vowels. On the other hand, the vowels as the nuclei of syllables, support prosodic characteristics and provide the major medium for individual and regional variations in the spoken language.

In sum, the higher error on vowels might be related to the embedded and context-sensitive status of vowels in speech. Let us refer to this as the "universal" interpretation, for it emphasizes aspects common to all languages. This universal interpretation can be contrasted with one that might be termed "particular", so-called because it emphasizes the particularities of the English orthography. On this second interpretation of Shankweiler and Liberman's (1972), the higher error rate for medial vowels might be due to the fact that many of the complexities of English spelling are concentrated on the vowels—there are many possible pronunciations for most of the vowel graphemes and each vowel phoneme can be transcribed by one of several graphemes (Dewey, 1970). (For example, /u/ is represented by a number of different letters or digraphs: u, o, oo, ew, etc.) Relevant to the particular interpretation of the magnitude of vowel errors is Shankweiler and Liberman's (1972) report that the error rate on the individual medial vowels was related to their orthographic complexity, that

is, to the number of graphemes and digraphs by which they are represented in the orthography.

Evidence bearing on the foregoing interpretations of the differential rate of errors on medial vowels and initial and final consonants is to be found in a further study (Fowler, Liberman and Shankweiler, 1977) that was motivated in part by a concern for the difference between the consonant sets used for the syllable-initial and syllable-final consonants of the original experiment. This difference in consonant sets raised the question of whether the pattern of errors might in fact be due to the difference in the phonologic (or orthographic) properties of the consonants occupying the final and initial positions rather than to the positions themselves. With the consonant sets equated, the later experiment (Fowler *et al.*, 1977) replicated the position-dependency of consonant errors. As before, final consonant errors exceeded the errors on initial consonants by a margin of 2 : 1. Moreover it was shown that many phonetic features of the presented consonant were shared by the nature of the incorrect consonant that was given in its place. With regard to vowels, however, Fowler *et al.* reported that whether they placed vowels in initial, medial or final syllabic positions, errors did not vary systematically with position in the word. Further, the substituted (incorrect) vowels were not phonetically related to target words. Finally, there is evidence (Fowler, Shankweiler and Liberman, 1979) that learning to read entails a progressive appreciation of the different phonemic values that a vowel grapheme can assume and the orthographic contexts in which particular spelling-sound correspondences can apply.

It can be claimed, therefore, that the errors on vowels and consonants by beginning readers of English differ in nontrivial ways and mimic, in reading, an opposition between these phonemic categories that is universal in speech. It can also be claimed, however, that with respect to the vowels, the child's misreadings do not primarily reflect difficulties in phonological segmentation. The speech-related factors that account for consonant errors do not account for vowel errors. Fowler *et al.* (1979) and Liberman and Shankweiler *et al.* (1977) suggest, therefore, that the vowel errors are probably due to the complexity and variability of the spelling-to-sound correspondences in English. In brief, they suggest the *language-particular* interpretation of vowel errors rather than the *universal* interpretation. In the experiment reported here (which replicates with Yugoslav readers the conditions of the Shankweiler and Liberman experiments) it is also the particular interpretation that is favored although the dissociation in reading, of vowels and consonants, is not strictly upheld. For beginning readers of Serbo-Croatian vowel errors, like consonant errors, are owing largely and equally to speech-related factors.

The Serbo-Croatian writing system

The English and Serbo-Croatian languages differ in the depth of their alphabetic orthographies. As a consequence, the simple letter-sound correspondences of English are significantly more variable than the correspondences of Serbo-Croatian. Where the English writing system is both morphemic and phonemic in its reference, the Serbo-Croatian alphabet demonstrates a clear priority for the phonemic.

This simple correspondence between letter and sound reflects the deliberate

alphabet reforms introduced into Serbo-Croatian by Vuk Stefanović Karadžić and by Ljudevit Gaj in the 19th century. In this respect, the Serbo-Croatian orthography—which takes two forms, the Cyrillic and the Roman (see Lukatela, Savić, Ognjenović and Turvey, 1978)—might be regarded as a nearly ideal medium of instruction by advocates of a purely phonetic writing system for the initial teaching of reading: Each phoneme is transcribed by only one letter or letter pair and each letter or letter pair is always pronounced.¹ (In the Cyrillic version there are only single letters.)

Does the fact that the grapheme-phoneme correspondencies of Serbo-Croatian are direct and consistent facilitate their acquisition? If it does, then the beginning readers of Serbo-Croatian may be less subject to errors in their reading of vowels and consonants. It is our intention to compare the two classes of phonemes within and between the orthographies of English and Serbo-Croatian. To this end we give due consideration, in what immediately follows, to the different accents which the five vowels of Serbo-Croatian may assume, suggestive as they are of a violation of the claimed-for spelling-to-sound regularity.

There are four variants of accent that can appear in syllables of Serbo-Croatian (see Figure 1). There is both a falling and a rising voice, each of which can occur in both a short and in a long form. These variations in accent can uniquely distinguish among different words (e.g., Sedi²), but they are not specified by the script. The possible accents for any particular vowel are constrained by the position of the syllable within

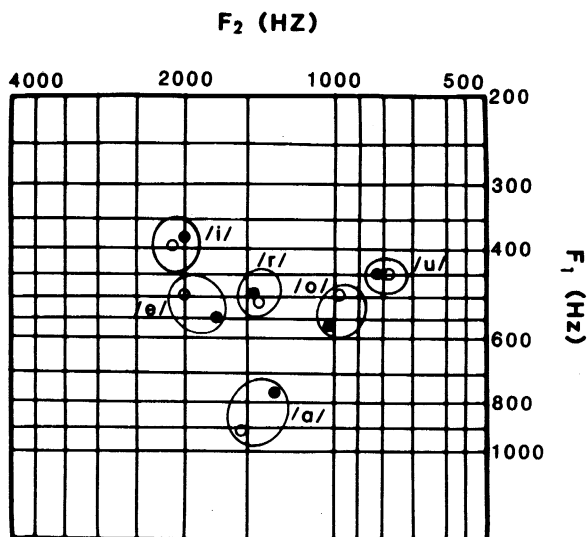


FIGURE 1. Acoustic vowel diagram of accented syllable nuclei occurring in approximately 400 Serbo-Croatian words produced by one speaker. Filled dots represent syllable nuclei bearing the short falling accent: Circles represent syllable nuclei with the long falling accent. (Modified from Lehiste and Ivić, 1963, p. 84.)

¹ There are exceptions to this characterization: For example, the first "d" in "predsednik" is generally interpreted as /t/. The number of violations is small, however.

² "Sedi", with differing accents can mean grey as an adjective, a man with grey hair, the third person singular of the verb "to grey" or the third person singular of the verb "to sit".

the word: Polysyllabic words may have any of the four accents on the penultimate syllable but the last syllable is usually unaccented. For monosyllabic words—the kind used in the present experiment—only long or short (falling) accents are possible.

As mentioned above, the Serbo-Croatian vowel set contains only five members. In terms of the F_1 - F_2 vowel space, these vowels are qualitatively distinct as no region is shared by two different identities. One could claim that the four accents for each vowel introduce complexity into the simple and systematic relation between grapheme and phoneme as there are sometimes four possible interpretations for a particular Serbo-Croatian vowel grapheme. An inspection of acoustic parameters, however, suggests that the determiners of accent are basically independent of the particular vowel—that vowel identity, at least as it is defined by formant structure in some restricted phonemic environments (Kalić, 1964), is not disturbed by variations in accent. These accent options for Serbo-Croatian vowels are to be contrasted with the complexities which characterize the pronunciation and the acoustics of English vowels. Of potential significance is the claim (Magner and Matejka, 1971) that the ideal accentual system as presented in Serbo-Croatian grammars “has little or no relationship with the accentual system(s) employed in many urban areas” [p. 189]. Speakers in the Magner and Matejka (1971) study could not always differentiate the four accentual variants. Discrimination between short rising and short falling forms was particularly vulnerable to error although contrasts between long rising and long falling accents were also commonly missed.

The implication of the foregoing is that the accent imposed on a particular vowel does not seem to influence its identification relative to other vowel options. So, for the child learning to read in Serbo-Croatian, the orthography will respect a simple, relatively context-free mapping between grapheme and phoneme for both vowels and consonants relative to the English orthography where the relationship for vowels is substantially more complex than the relationship for consonants. It is important to underscore that the *orthographically* distinct vowels of Serbo-Croatian are also *phonetically* distinct, in terms of the formant defined vowel space. It will not be possible, therefore, to distinguish orthographic from phonetic effects among Serbo-Croatian vowels.

Method

Subjects

Sixty-five first grade students at an elementary school in Belgrade participated in this study. Their ages ranged from 6·5 to 7·5 years and all had IQs within the normal range. At the time of testing, they had completed their first semester of school and had an active knowledge of the Cyrillic alphabet.

Materials and design

Two hundred monosyllabic letter strings patterned as consonant-vowel-consonant (CVC) were constructed. One half of these CVCs were words and one half were pseudowords. All words were familiar to first graders as determined by Lukić (1965) and by consultation with the children's teachers. Following Fowler *et al.* (1977), in both the word and pseudoword lists, the twenty-five Serbo-Croatian consonant phonemes (which can occur in both the initial and in the final positions of a word) appeared twice in each position. In the majority of the trigrams, the

medial letter was one of the five Serbo-Croatian vowels (/i/, /e/, /a/, /o/, /u/). In some trigrams, however, the medial letter was the semi-vowel /r/. In Serbo-Croatian, monosyllabic words of this type—consonant—/r/—consonant—occur relatively frequently. Of the 100 words, 25 could be reversed to produce other words. For example, the word "BOR" (pine) if read from right to left becomes "ROB" (slave).

Each string of three uppercase Cyrillic characters was arranged horizontally at the center of a 3" × 5" white card. These stimuli were printed in Cyrillic such that individual letter shapes were similar to the form generally used by the classroom teacher. The cards were placed face down in front of the child and were turned over one by one by the examiner. Each child was asked to read each letter string aloud as it was presented. Responses were written down by the examiner and were recorded simultaneously on magnetic tape.

Each child participated in two sessions. As in the procedure adopted by Fowler *et al.* (1979), words and pseudowords were blocked into separate lists and one list was presented in each session. Children who read the word-list in the first session read the pseudoword-list in the second and vice versa. The order of presentation was balanced across children.

Results

The responses to the stimuli revealed several types of errors: (a) reversal of sequence in which a letter string or a part of it was read from right to left, (b) omission, (c) addition, (d) substitution. Single letter orientation errors did not occur because the Cyrillic upper case letters did not provide opportunity for reversing letter orientation.

Sequence reversals

The analysis of errors showed that sequence reversals accounted for only a small proportion of the total of misread letters even though the lists were constructed to provide ample opportunity for the complete reversal of the sequences. (As noted, 25% of the words were "reversible"; and 13% of the pseudowords were words if read from right to left, for example the pseudoword NIS would become SIN, meaning "son").

The complete sequence reversals are distinguished from the partial and the total reversal scores for words and pseudowords and are given in Table 1. Proportions of opportunity for error (in percentages) are presented within brackets. Sequence reversals were rare.

Omissions

Single letter omission errors were also quite rare. Their distribution on initial and final consonants and on medial vowel/semivowel is presented in Table II. Omissions of

TABLE I
Errors of sequence reversals (and proportion of opportunities, based on number of reversible letter strings)

	Complete sequence reversal	Partial sequence reversal	Total
Words	17 (1·1%)	6 (0·0%)	23
Pseudowords	21 (2·5%)	13 (1·5%)	34

the final consonant in words seem to be more frequent than in pseudowords but the respective proportions of opportunity are too small to allow any reliable conclusion on their distribution.

TABLE II
Omission errors

	Initial consonant	Medial vowel	Final consonant	Total
Words	1	4	11 (0.2%)	16
Pseudowords	4	3	3	10

Additions

Errors of addition were distributed in a nonrandom manner (see Table III). Additions of a single phoneme were more frequent before the final consonant (FC₁) than after the final consonant (FC₂), other types of additions being relatively infrequent.

TABLE III
Errors of addition of a single phoneme

	Initial consonant	Medial vowel	Before final consonant FC ₁	After final consonant FC ₂	Total
Words	6	10	52	12	80
Pseudowords	1	9	52	25	87

In words and pseudowords where the medial letter was R (the semivowel /r/), additions of a single phoneme in front of the final consonant and after the semi-vowel were the most frequent. For example, the word GRB was often misread as /grab/, /grub/, or /grob/. In four words (GRB, VRH, TRG, TRN) there were 45 single vowel additions and in four pseudowords (BRS, DRN, KRP, PRK) there were 47 single vowel additions of FC₁ type. (Although all letter strings were printed in Cyrillic script, the Roman equivalents are presented here.) The proportion of opportunity for this particular error expressed as a percentage was 17 in the four words and 18 in the four pseudowords. This is a notable result. Apparently, in order to facilitate the phonetic representation of the letter string the child inserted a vowel between the medial semivowel and final consonant.

Substitutions

Substitutions of single phonemes were the major sources of error. The distribution of substitution errors on the initial and final consonant and on the medial vowel/semivowel for both words and pseudowords is presented in Table IV which gives the raw error scores and the respective percentage (within brackets).

TABLE IV
Single phoneme substitution errors

	Initial consonant	Medial vowel	Final consonant	Total
Words	172 (2.6%)	93 (1.4%)	264 (4.1%)	529
Pseudowords	213 (3.3%)	113 (1.7%)	368 (5.7%)	693

An analysis of variance on total errors revealed that the word-pseudoword or lexicality contrast was not a significant source of variance, $F(1, 198) = 3.51$, $MS_e = 43.74$, $P < 0.10$; neither was the interaction between lexicality and position within the syllable, $F(2, 396) = 0.93$, $MS_e = 10.69$, $P > 0.25$. On the other hand, the position of a letter in a syllable was a highly significant contributor to the overall variance, $F(2, 198) = 21.5$, $MS_e = 10.69$, $P < 0.001$. A protected t -test confirmed the previously-reported inferiority of performance on the final consonant relative to performance on the initial consonant in the present data $t(99) = 268$, $P < 0.001$. However, it is plainly the case that performance on the vowels was inferior to performance on neither the initial nor final consonants. In fact, protected t -tests reveal that performance on vowels was superior to performance on both initial and final consonants $t(99) = 196$, $P < 0.001$ and $t(99) = 463$, $P < 0.001$ respectively. This is contrary to the findings in English.

Closer inspection of the children's response protocols revealed that syllables which included the characters υ , u , h , h , symbolizing, respectively, the affricates $/t\check{f}/$, $/d\check{z}/$, $/t\check{f}j/$, $/d\check{z}j/$ were disproportionately subject to error. The affricates are notoriously more difficult to distinguish by ear and to produce distinctively than other sounds of Serbo-Croatian. Excluding those syllables (17 words and 17 pseudowords) in which affricates occurred in either initial or final position substantially reduced the overall errors and eliminated the absolute difference between the initial consonant errors and the medial vowel errors as can be seen in Table V.

Relation between errors and target consonants

A matrix of confusions between stimulus letter and substituted response was constructed separately for initial position and for final position errors. A correlation of the two matrices yielded a value of $r = 0.73$; which means that 53% of the variance in the patterns of errors for initial and final consonants was common.

TABLE V
*Errors when the affricates (υ , u , h , and h) were excluded**

	Initial consonant	Medial vowel	Final consonant
Words	44	51	124
Pseudowords	104	97	258

* Total errors with 17 word stimuli and 17 pseudoword stimuli excluded.

A correlation was then computed between the number of shared phonetic features and the frequency of error. (Only those target-error combinations were included in which a subject actually produced an error.) Using Jakobson's (1962) feature matrix for Serbo-Croatian and including the feature values for those features which need not be specified in order to capture only the minimal distinctive contrasts of the Serbo-Croatian phonology, two new matrices of shared features were created—one for target vowels (including /r/) with error vowels and one for consonants (including /r/) with consonants. Here, shared features can assume seven values. For word-initial consonants, the relation between common features and frequency of errors among presented-substituted letter pairs was $r = 0.23$, $N = 200$, $P < 0.01$. For word-final consonants, the relation was $r = 0.30$, $N = 200$, $P < 0.01$. In both cases, the frequency of confusions and number of shared phonetic features do correlate. We can interpret this to mean that phonetic similarity does account significantly for some portion of the variance in the pattern of confusions among presented and substituted consonant pairs. This finding is consistent with the pattern of errors derived from studies of English consonants (Fowler *et al.*, 1977).

Relation between errors and target vowels

Unlike the English vowel findings, however, the vowel confusions in Serbo-Croatian can also be related to the degree of phonetic contrast. The proportion of error confusions is given in Table VI. The correlation between number of shared features and frequency of each presented-substituted letter pair confusion was $r = 0.52$, $N = 30$, $P < 0.001$. This value of r is particularly high given the restricted range

TABLE VI
Percent of total errors

	a	e	i	o	u	r
a		9	2	10	3	
e	9		5	2	1	
i	2	5		1	4	
o	10	4	1		3	
u	2	1	1	8		
r	8	1	1	3	3	

Rows represent presented vowel. Columns represent incorrect substitution. (r was never substituted for another vowel.)

(vowels share between 3 and 6 features) and the relatively small N (there are 30 possible confusions). It suggests that the vowel substitutions of Serbo-Croatian, like the consonant substitutions of Serbo-Croatian and unlike the vowel substitutions of English are, at least in part, phonetically governed.

Discussion

The two major contrasts between the present data for beginning readers of Serbo-Croatian and those previously reported for beginning readers of English are that: (1) vowels in the medial position of a written consonant-vowel-consonant syllable are no more likely to be read incorrectly—indeed are less likely to be given an incorrect reading—than the initial and final consonants: and (2) vowel errors are no less likely to be rationalized by phonetic feature considerations than are consonant errors. Let us consider each contrast in turn.

As noted above, the Serbo-Croatian vowel set is numerically smaller than its English counterpart (the Serbo-Croatian vowels are only five in number) and qualitatively better defined (the Serbo-Croatian vowels are non-overlapping in the F_1 - F_2 space regardless of accent). Is the fact that the Serbo-Croatian vowel set is smaller—and, therefore, that the likelihood of correctly reading a member of the set by chance is greater—reason enough for the proportionately smaller number of errors on Serbo-Croatian vowels? A guessing explanation is worthy of consideration if there is a good reason to believe that a random guessing strategy was being used. There were, in all, 13,000 opportunities for vowel errors in the present experiment (200 syllables, 65 subjects). As is evident from Table IV, the number of actual vowel errors totaled 205 which is far below the number of errors to be expected if the children were merely guessing at the vowels. (Since the guessing probability for consonants is trivially low, it would not alter the actual error rate and is not discussed.) Clearly a general guessing strategy has to be ruled out which does not, of course, rule out guessing as a back-up strategy when all else fails. The 205 errors, therefore, might be interpreted as representing those occasions on which the children were forced to guess and guessed wrongly. Which is to say that 205 represents four-fifths of all those occasions when the children guessed because on one-fifth of these occasions they guessed *correctly*. By this reasoning, therefore, the number of times the children were forced to guess amounted to about 256 so that even disallowing correct guessing would not elevate the vowel errors above the consonant errors (see Table VII). In short, the fact that the vowels were not the major source of errors for beginning readers of Serbo-Croatian, as they were for beginning readers of English, is probably not attributable—at least, not in full—to the smaller size of the Serbo-Croatian vowel set; that it might be attributable, in larger part, to the greater distinctiveness of members of Serbo-Croatian vowel set is considered below.

Let us now turn to the observation that beginning readers of Serbo-Croatian produced vowel errors that were, like consonant errors, rationalized by the degree of

TABLE VII

*Total number of errors including all CVC strings
(i.e. 100 word stimuli, and 100 pseudoword stimuli)*

	Initial consonant	Medial vowel	Final consonant
Words	172	93	264
Pseudowords	213	112	368

phonetic contrast. Recall that the observation for beginning readers of English was that vowel errors, unlike consonant errors, did not bear a feature-based relation to their target sounds (Fowler *et al.*, 1979). This contrast might index a significant difference between the two orthographies and the challenge they pose to the neophyte reader. However, attempts to cash this promissory note must be prefaced by a necessary caveat: That the aforementioned contrast could be illusory, a trivial consequence of whether one has hit upon the propriety feature set for defining vowels. Possibly, a feature matrix for English vowels other than that used by Fowler *et al.* (1979) would capture a more pronounced phonemic basis for the vowel errors of their beginning readers.

Assuming that this possibility is not correct we can raise two questions concerning the contrast currently under consideration: (1) Why should the errors in reading Serbo-Croatian vowels be speech-related when the errors in reading English vowels are not?; and (2) What are the consequences for (beginning) reading of this conformity of vowels and consonants in Serbo-Croatian and this dissociation of vowels and consonants in English? As adumbrated in the introduction, the Serbo-Croatian orthography is phonographic in a way that the English orthography is not, viz., that totally reliable guides to the pronunciation of a word occur even at the orthographic grain-size of the single letter. English orthography, being simultaneously but complexly a representation of morphology and phonology—where these representations are mixed fairly inconsistently from word to word (Gleitman and Rozin, 1977)—mandates that often the only reliable guides to pronunciation are to be found at an orthographic grain size that sometimes encompasses several letters and very often encompasses entire words. Put differently, English orthography is partly morphemic. Thus, the beginning reader of Serbo-Croatian can relate to the orthography as simply a phonological representation and derive the pronunciations of the “consonantal” and “vocalic” constituents of a word purely on phonological grounds. In comparison, the beginning reader of English must relate to the orthography as both a phonological representation and a morphological representation and may not necessarily be able to derive the pronunciations of the “consonantal” and “vocalic” constituents of a word in precisely the same way as the beginning reader of Serbo-Croatian.

Consider now a theory of initial reading acquisition that follows from the notions of linguistic awareness and encodedness (Mattingly, 1972). A fairly standard scenario is one in which the visual form of a word seen by the child co-occurs with the acoustic form produced by the “teacher”. Now it must be assumed that the child’s internal lexicon already represents familiar words in a way sufficient for the purposes of saying them and recognizing them when heard. These representations have been established largely on tacit grounds as the inevitable consequence of a decoding device that condenses out discrete phonemes from the continuous speech stream. In learning to read analytically, however, that which is normally done tacitly must now be done explicitly: The heard word produced by the “teacher” must be explicitly decomposed into its constituents in order to effect a mapping between its structure and the constituent structure of the seen symbol string.

Somehow, the child must actively fashion either a special lexicon, one to which visually encountered words can be referred, or a new (orthographic) way of accessing

the already-existing (phonologically accessibled) lexicon. In either case, the facility with which the child can internally represent written words as ordered linguistic segments abstractly consonant with the ordered visual segments depends on the child's linguistic awareness, the awareness that speech is divisible into those phonological segments that the letters represent (Lieberman, Liberman, Mattingly and Shankweiler, 1980). If a special lexicon is fashioned then it should be referred to as an *explicit* lexicon (to distinguish it from the lexicon fashioned on mainly tacit grounds that supports speech perception and speech production). This explicit lexicon will be fallible and, similarly, the fashioning of a new mode of lexical access will be difficult, to the degree that the encodedness of speech obscures for the individual listener the phonemic composition of heard words.

We return at this juncture to a focal question: Is an appeal to encodedness sufficient to account for the difference in the relative magnitudes of vowel errors between beginning readers of English and beginning readers of Serbo-Croatian? It would seem not. The degree to which words resist explicit decomposition into their constituent phonemes should be more or less the same for both languages. However, the non-overlapping nature of the Serbo-Croatian vowel space would guarantee greater consistency in the assignment of internal descriptors to the vowels in the formation of an internal representation. And in this regard the fact that, for spoken Serbo-Croatian, any one point in the F_1 - F_2 space is associated with only one vowel (or no vowel at all) is buttressed by the fact that, for written Serbo-Croatian, any one vowel character in the alphabet is associated with only one vowel phoneme. It can be argued, therefore, on two counts, that the pronunciation of a Serbo-Croatian vowel (by a beginning reader) is more likely to be correct, *ceteris paribus*, than the pronunciation of an English vowel (by a beginning reader). However, it remains equivocal whether the truth of this argument is grounded in the orthography or the phonology of Serbo-Croatian vowels.

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