

Phonological and Orthographic Relationships to Reading Performance

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This study investigated the use of an intermediate level of orthographic representation based upon the theoretical framework of transformational-generative grammar. A general objective was to determine whether a system of semantic correspondence was utilized when irrelevant phonetic aspects of orthography were encountered by good and poor readers from a fifth-grade population. A $2 \times 2 \times 4$ factorial design was employed to investigate the effects of reading ability (good and poor), word reality (real and pseudo), and mode of presentation for stimuli and response items (oral and written). Good readers performed better than poor readers at a statistically significant level ($p < .0005$) on those tasks which required recognizing regularities on a deep level. When regularities were recognized on a surface level, these differences between good and poor readers diminished. Good readers appeared to display a search technique which abandons a simpler level of correspondence in favor of one more efficient, one which precludes grapheme/phoneme correspondences for one directed toward semantic correspondence.

The purpose of this study was to investigate the abilities of good and poor readers to recognize the form of derived words where morphophonemic alternation occurs but orthographic constancy exists. Recent models of linguistic (Chomsky and Halle, 1968; Venezky, 1970b) and reading (MacDonald, 1969) competence point to regular phonological rules which are reflected in the tasks. Normative performance data which may reflect the developmental acquisition of such competence is nonexistent. It is with this exploratory aspect in mind that this study was undertaken.

The standpoint that the reading process may be described in direct letter-to-sound terms seems unfeasible. American descriptivists such as Bloomfield (1961) and Fries (1963) recognized the unphonemic elements of English orthography and considered them deviations to be taught last. This concern for the degree of letter-to-sound match has characterized the question of the regularity of the English spelling system. Recent evidence suggests that phonic generalizations may

not adequately equip students for their encounters with English words (Bailey, 1967; Burmeister, 1968; Clymer, 1963; Emans, 1967). Current descriptions of the relationship between conventional English orthography and the sound system of the language lend support to the belief that the orthographic system employed in English is far more regular than previously thought. In fact, it may be considered a near optimal system for native speakers of English (C. Chomsky, 1970; N. Chomsky, 1970). As Venezky (1970a) and Chomsky and Halle (1968) have shown, a direct letter-to-sound relationship description, though simpler, is a less adequate method linguistically. The system is not based on such a univariate foundation alone. Rather, it corresponds to a more abstract level of representation. Venezky (1967) states, "Spelling units are not related directly to sound, but to an intermediate (morphophonemic) level first, and then to sound [p. 84]." Evidence for the support of abstract rules on psychologically valid grounds has been reported by Ainsfeld (1969).

According to phonological theory within the framework of transformational grammar, in the lexical level of representation of a word many phonetic features of spoken language are suppressed. Although phonetic variations are considerable, they are automatic in the phonological system of the language. Conventional orthography, on the other hand, ignores them and by corresponding to lexical spelling rather than phonetic representation, "permits immediate direct identification of the lexical item in question, without requiring the reader to abstract away from irrelevant phonetic detail [C. Chomsky, 1970, p. 291]."

An orthography which corresponds directly in letter-to-sound terms represents the phonetic features of a lexicon, such as exhibited in the International Phonetic Alphabet. With this system the graphic depiction of spoken language is attempted; the items "mortal" and "mortality" are represented as /^hmɔrtl/ and /mɔrt^hælətɪ/. The pair of words, because of the vowel alternation, receives two different spellings and each member of the pair constitutes a separate lexical item. Conventional orthography, however, indicates the semantic relationship between pair members by disregarding the automatic pronunciation shift and by presenting the members as variant forms of the same word. This maintenance of semantic correspondence

(or morpheme identity) reveals a regularity between semantically related items which a phonetic orthography disregards. The pair of items “mortal” and “mortality” are preserved in conventional orthography as semantically related lexical entities, although phonological changes are apparent. By this system, then, a higher order of regularity may be observed than by a direct letter-to-sound representation method.

Briefly, orthographic representation is not bound to phonemic description alone (Francis, 1958). A more complex level of generalization is inherent in the system as it exists, the function of which is to provide a means of semantic transmission rather than one of only phonological transmission (Vachek, 1966). A knowledge of this higher order system should enable skilled readers to process words perhaps as larger graphemic units rather than as units to be broken into phonological components to be matched with oral counterparts.

It is suggested, therefore, that “what the mature reader seeks and recognizes when he reads is not what are commonly called grapheme/phoneme correspondences, but rather the correspondence of a written symbol to the abstract lexical spelling of words [C. Chomsky, 1970, p. 296].” “In order to progress to more complex stages of reading, the child must abandon this early hypothesis and come eventually to interpret written symbols as corresponding to more abstract lexical spellings [C. Chomsky, 1970, p. 297].” Thus an indirect relationship of orthography to pronunciation must be learned.

As an illustration, consider the relationship of orthography to spoken language. Phonological variation of lexical items in the language is abundant: across time, across group norms, across social context, and across syntactical and phonological environments. Consistency in orthographic representation operates as somewhat of a common denominator for such variation. Semantic similarity is coded through spelling. The item “iron” will be expressed consistently despite the phonological variants /'am/ and /'ærn/. Likewise, where phonological change occurs due to suffix addition, semantic similarity is maintained as in the pair /dɪ 'fam/ and defa 'nɪʃən/, “define” and “definition.”

The relationship of phonological processing ability to reading ability is unclear. A study done by Robinson (1967) on the develop-

mental pronunciation of suffixed words indicates that the system seems, indeed, to be one not fully internalized by the time the children may need it for reading. The four age levels tested were grades three, six, nine, and adult. Subjects were asked to form suffixed words from theme words and theme words from suffixed words. Ability was measured in terms of stress placement and vowel and consonant values. The tasks, then, required encoding by the subjects after they read the stimulus sentence. Results indicated that there were fairly regular developmental progressions in the abilities measured and performance was significantly better on real words than on pseudo words.

Theoreticians have proposed that at least in the formative stages of reading, a process of inner speech occurs. Carroll (1969) states, "Silent reading of a printed message involves decoding the message into some form of covert spoken behavior or 'inner speech,' and that in turn, if the message is to be understood, doubtless depends on an underlying competence in the grammatical and semantic rules of the language [p. 6]." According to the Goodman (1968) schema this conversion into an inner speech is classified as a "recoding" stage; the term "decoding" is reserved for a subsequent stage whereby meaning is acquired.

While the degree to which inner speech is present in suffixed words has not been researched, the phenomenon of subvocalization in reading has been demonstrated. Edfeldt's (1959) study shows an increase in subvocalization, as measured by electromyographic methods, as reading material becomes more difficult. In light of C. Chomsky's (1970) comments, the question remains unanswered as to whether processing written words with inner speech represents an early stage of reading which may be reverted to. The suggestion exists that different stages of reading may be employed by the individual as the difficulty of the material varies for him.

Existing research on the distinctions between good and poor readers has been primarily of a descriptive-correlational nature. Langman (1960) suggests that what poor readers lack in learning to read is the "ability to direct attention to the significant visual and auditory stimuli in word recognition situations [p. 31]." Hence in the case of suffixed words, the good reader may be focusing on the "common item" relationship with the theme word, while the poor

reader is still doggedly attempting to translate or "recode" on the direct grapheme-phoneme basis.

The term "significant stimuli" under such conditions would suggest that the stimuli to be pursued first would be that of a semantic relationship, and second, the grapheme/phoneme correspondence relationship. This followed to its logical conclusion would suggest that the good reader exploits the "morphophonemic" nature of the orthography more than the poor reader does. And concomitantly in doing so, he has focused attention on a semantic relationship which facilitates Goodman's (1968) "decoding" stage.

The good reader, then, may be said to impose the significant structure upon a derived word. Neisser (1967) contends that in word perception the subject constructs what he sees in an act labeled "figural synthesis." "In this sense it is important to think of focal attention as a constructive, synthetic activity rather than as purely analytic. One does not simply examine the input and make a decision; one *builds* an appropriate visual object [Neisser, 1967, p. 94]." This type of cognitive processing, it would seem, may be derived from the subject's set to search for such relationships. Such performance appears somewhat unsurprising in light of the findings of Levin and Watson (1963) that a "set for diversity" is advantageous; that is, if subjects are presented with multiple correspondences early in instruction, in contrast to a one-to-one correspondence as in "linguistic" readers, they will be more likely to develop a useful problem-solving approach to the reading task.

One question pursued in this study was whether conventional English orthography may be considered "optimal" in contrast to a more "phonemic" orthography. To explore this dimension, derivationally formed words were employed where consonant and vowel values regularly change by rule from the theme form to the derived form, e.g., *logic/logician*, *rise/risen*, *baron/baronial*. Both real words and pseudo words were used to measure the degree to which the rule systems and cue systems were internalized.

Phonological performance, as measured by a recognition task, was investigated. Questions pursued were the degree to which such performance exists in both real words and pseudo words and the degree to which it discriminates between good and poor readers. It

was investigated in terms of both oral and visual (orthographic) method of presentation and mode of response.

Thus an oral/oral task measured subjects' ability to auditorily recognize the correct form of derivational relationships where consonant and vowel alternation occurs. In such a task the theme form (or root word) of the target word was verbalized within a spoken sentence context: for response, four verbalized alternatives were presented as slot fillers of a spoken sentence used for context. For example, the word "revere" was used in a sentence which was read aloud by the experimenter. After the sentence was read, the word "revere" was said aloud twice by the experimenter. A second sentence containing the word "reverence" was read aloud by the experimenter. The word "reverence" was not said, but the position of it was indicated by the sound of a toy cricket. Four pronunciations of "reverence" were presented on a tape recorder, one item was to be selected as correct.

An oral/visual task measured subjects' ability to relate a changed phonetic form to orthographic representation, a skill of spelling in contrast to reading. Good readers would be expected to perform better on such a task. Furness (1956) found that the correlations between scores on reading tests and scores on spelling tests usually fall in the range of .80 to .85; Otto and McMenemy (1966) and Harris (1970) warn, however, that even though poor readers are rarely good spellers, good readers may be poor spellers. In this task the theme form of the target word was verbalized within a spoken sentence context: for response items, four orthographically depicted items were presented as slot fillers of a spoken sentence used for context. For example, the word "revere" was used in a sentence which was read aloud by the experimenter. After the sentence was read, the word "revere" was said aloud twice by the experimenter. A second sentence was read aloud by the experimenter. The word "reverence" was not said, but the position of it was indicated by the sound of a toy cricket. Four orthographic depictions of "reverence" were presented by an overhead projector; one item was to be selected as correct.

A visual/oral task measured subjects' ability to ascribe the correct changed phonetic form auditorily from a stimulus presented in conventional orthography, as may occur in oral or subvocal reading.

The target word was presented in orthographic form within a spoken sentence context. The response items were presented as in the oral/oral task. For example, the word "revere" was presented by an overhead projector while a sentence, in which the word was used, was read aloud by the experimenter. The position of "revere" in the sentence was indicated by the sound of a toy cricket. A second sentence was read aloud by the experimenter. The word "reverence" was not said, but the position of it was indicated by the sound of a toy cricket. Four pronunciations of "reverence" were presented on a tape recorder; one item was to be selected as correct.

Finally, a visual/visual task measured subjects' ability to recognize a derivational relationship by cues provided by the orthography, a reading skill of bypassing direct spelling-to-sound correspondences to the facilitation of semantic relationships. The target word stimulus was presented in conventional orthography within a spoken sentence context. The response was presented as in the oral/visual task. For example, the word "revere" was presented by an overhead projector while a sentence, in which the word was used, was read aloud by the experimenter. The position of "revere" in the sentence was indicated by the sound of a toy cricket. A second sentence was read aloud by the experimenter. The word "reverence" was not said, but the position of it was indicated by the sound of a toy cricket. Four orthographic depictions of "reverence" were presented by an overhead projector; one item was to be selected as correct.

Nine hypotheses were tested to answer a number of particular questions since the research was considered exploratory in nature. The orthogonal comparisons in hypotheses one through eight were considered overriding concerns in the analysis of the data. Hypothesis nine was tested to help clarify the issue of the optimality of conventional orthography compared to a phonemically mapped one.

It was expected that good readers would perform better than poor readers on the four tasks involving modality variation as C. Chomsky (1970) suggests the ability of the child to interpret the orthography directly at the lexical level should increase naturally as his phonological competence increases. Additionally, on the spelling-like task good readers would be expected to perform better, as well as on the seemingly reading-like tasks.

The work of Robinson (1967) would suggest that performance on

real words would be better than on pseudo words. Knowledge of real words may clearly confound the testing of principles where word samples are used.

Finally, the theoretical constructs of the conventional orthographic system would suggest that such a system, though more complex, is more efficient.

The nine hypotheses which were tested follow:

1. Good readers will perform significantly better than poor readers on (a) the oral/oral task, (b) the oral/visual task, (c) the visual/oral task, and (d) the visual/visual task.

2. Performance on real words will be significantly better than on pseudo words on (a) the oral/oral task, (b) the oral/visual task, (c) the visual/oral task, and (d) the visual/visual task.

3. Subjects will select the correct response reflecting conventional English orthography more frequently than phonemic approximations in the visual/visual task.

Subjects

The sample was provided by eighty fifth graders from four elementary schools in Sun Prairie, Wisconsin. The school population draws from social classes ranging from upper-lower to upper-middle and from both urban and rural settings. Forty good readers and forty poor readers were represented by an equal number of males and females. Subjects were operationally defined as good readers by scores above the fifth stanine on both the word meaning and paragraph meaning subtests of the *Stanford Achievement Test, Intermediate II*; poor readers were operationally defined by occurrence of both scores in the second, third, and fourth stanines.

Method

A $2 \times 2 \times 4$ factorial design was employed to investigate the effects of reading ability (good and poor), word reality (real and pseudo), and modality of stimulus and response (oral/oral, oral/visual, visual/oral, and visual/visual). Five subjects were assigned to each of the 16 cells.

The task of 110 items reflected 22 morphophonemic alternation types. Eight reflected consonant changes: {k-s}, and seven synthesis patterns, {t-č}, {t-š}, {d-j}, {s-š}, {s-ž}, {z-ž}, and {k-š}, as

in *act/action*. Five patterns consisted of vowel alternation, from free alternate (long pronunciation of a vowel) to checked alternate (short pronunciation of a vowel), where major stress patterns did not change: {e-æ}, {i-ε}, {ai-I}, {o-α}, and {ju-Λ}, as in *sane/sanity*. And the remaining nine patterns consisted of vowel alternations dependent upon major stress pattern change. Four of these were due to the loss of stress: {e-ə}, {i-ə}, {ai-ə}, and {æ-ə}, as in *horizon/horizontal*. Five were due to the acquisition of stress: {ə-e}, {ə-i}, {ə-α}, {ə-æ}, and {ə-o}, as in *mortal/mortality*.

The words selected for the tasks reflected alternation rules described by Venezky (1970b). The corpus of words were composed from a sample taken from *Webster's New School and Office Dictionary* (1965). Five individual items from each category were selected. Where several varieties of morphemes were available to serve as suffixes, word samples were placed in "identical morpheme" groups. The number of items were then selected according to the proportional frequency which a morpheme group represented. Hence, if 20 cases of *-ity* and 17 cases of *-ism* were the existing suffixes available, three items were selected from the *-ity* group and two items from the *-ism* group. In cases where several suffix patterns existed, samples were drawn from the five most abundant groups. For those cases not so clear cut, the writer utilized a random method, the words not being seen.

Real words were classified to provide a body of semantically related samples to draw from. Because word-frequency (Savin, 1963) and word length (McGinnies, Comer, & Lacy, 1952) may contribute to difficulty, words were randomly selected from all within groups. Pseudo-words were constructed to reflect the concomitant alternations displayed by real words. The pseudo-words were read for their proximity to real words and for their assigned created meanings by three persons, each representing one of the disciplines of reading, linguistics, and literature. Revisions were made on the basis of suggestions.

The task consisted of two straightforward sentences of a definitional context being read to the subjects. The slot position of the target word in sentence one was indicated by the sound of a toy cricket and subjects were exposed to the theme form either visually or acoustically. The same operation was performed with the second

sentence. Four systematic response choices were provided for the derived forms either by an overhead projector or by magnetic tape. Subjects were instructed to select the alternative which seemed correct. Neisser (1967) suggests such a scanning technique so that the presence of an "after image" does not impose a template effect. His discussion is directed towards visual images, but it is reasonable to expect that the same effect may operate auditorily. Items answered correctly were tabulated for each subject and mean scores for each cell were calculated.

The lexical items which constituted the sentential context for the target words were restricted so that they fell below the purported median free association vocabulary size of fifth graders (Bryan, 1953). Only words falling below this median were utilized by comparison to the Kučera and Francis (1967) word frequency list.

All items for the task were ordered at random. Response choices varied systematically, focusing on those phonemes which alternated. In stress shifting words, the focus of attention was placed on the vowel linearly nearest the added suffix. The order of response alternatives was assigned by random. See Appendix A.

Four measures of internal consistency were computed as a method of determining the reliability of the task. Using a Pearson r for the calculations, the correlations are as follows: real words = .90, pseudo-words = .90, good readers = .87, and poor readers = .88.

Results

The analysis of the data was pursued through four major types of tests. Hypotheses 1 through 8 were tested by a planned comparisons technique. This method is suggested (Hays, 1963, Chapter 14), instead of an ordinary analysis of variance and F-test, when one has particular questions to be answered at the onset of an experiment. It is an assurance that comparisons are unrelated and nonredundant.

Hypothesis 9 was tested by a single-sample test involving proportions (Blalock, 1960). This was necessary since the focus of the hypothesis was on the degree to which conventional orthography was utilized in comparison to phonemic approximation spellings.

Following the testing of hypotheses 1 through 8, an F-test for "other comparisons" was made. "If this F-value is significant, then

[those] comparisons of secondary interest can be examined individually by post-hoc methods [Hays, 1963, p. 478].”

Several Scheffé post-hoc comparisons were computed. Following the recommendation of Hays (1963) not all conceivable comparisons were made. Rather, comparisons were made where the writer, upon inspection of the data, suspected large effect to lie.

Hypotheses 1 through 8 were tested by the technique of planned comparisons. Two conditions must be met before these comparisons may be considered independent and nonoverlapping. First, an assumption was made that population distributions were normal. Second, the condition of orthogonality was met. The criterion of orthogonality in planned comparisons assures one that comparisons are statistically independent. The conditions set for achieving orthogonality were met for the 8 comparisons which were made.

The planned comparisons of good readers and poor readers (Hypotheses 1 through 4) indicated that good readers performed significantly better than poor readers on the o/o ($p < .0005$), o/v ($p < .0005$), v/o ($p < .0005$), and v/v ($p < .025$) tasks. It was observed that performance differences on the v/v task did not reach the significance level exhibited in the other three tasks. The results are presented in Table I. The results of the post-hoc investigations help to clarify the interaction which took place and which help to account for this anomaly.

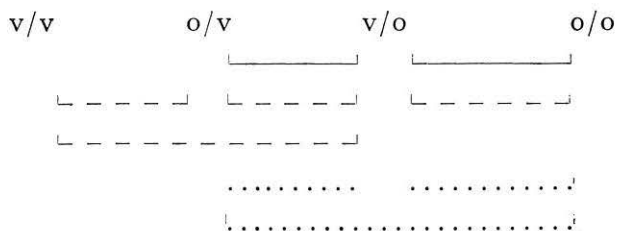
Performance on real words was significantly better than on pseudo= words (Hypotheses 5, 6, and 7) in the o/o ($p < .0005$), o/v ($p < .05$), and v/o ($p < .0005$) tasks. Performance on the v/v task was not significantly different ($p > .05$). Results are presented in Table I.

It was shown that the v/v task rewarded the simple recognition of surface structure similarity, whereas the o/o, o/v, and v/o tasks demanded a recognition of deep level correspondence. As the rule which operated did not involve recovery from underlying forms in the v/v task, the comparison of performance with real and pseudo= words did not seem affected by knowledge of individual lexical items. That is, knowledge of the grammar system did not seem to be measured by the v/v task and, hence, real word knowledge did not inflate performance scores on real words.

Conventional orthography was used in preference to phonemic representations significantly more often in the visual/visual task.

TABLE I. Summary of Planned Comparisons Tests

Source	SS	df	MS	F	t	Probability
Between groups	29,711.4	15				
Comparison:						
1. o/o, Gd. > Pr.	1,843.2	1	1,843.2	12.29	3.5060	.0005
2. o/v, Gd. > Pr.	6,808.0	1	6,808.0	45.41	6.7381	.0005
3. v/o, Gd. > Pr.	3,175.2	1	3,175.2	21.18	4.6016	.0005
4. v/v, Gd. > Pr.	649.8	1	649.8	4.33	2.0817	.025
5. o/o, R > Pdo.	2,464.2	1	2,464.2	16.44	4.0538	.0005
6. o/v, R > Pdo.	451.2	1	451.2	3.01	1.7347	.05
7. v/o, R > Pdo.	1,805.0	1	1,805.0	12.04	3.4695	.0005
8. v/v, R > Pdo.	28.8	1	28.8	.19	-.4383	
Remainder	12,486.0	7	1,783.7	11.90		.001
Error (Within groups)	9,595.6	64	149.9			



- No significant difference—overall group
- - - No significant difference — good readers
- . . . No significant difference—poor readers

Figure 1. Significant differences ($p < .05$) between readers and modality groups.

Since the task did not appear to measure what it purported to, an analysis was made of good and poor readers' use of conventional orthography in the oral/visual task. Good readers, it was found, used conventional orthography significantly more often than phonemic alternatives ($p < .009$); poor readers, on the other hand, did not to a significant degree ($p < .49$). The suggestion is that conventional orthography relates semantic units more effectively than an orthography representing phonemic approximation to sound in the case of derived words. This generalization appears to hold true once some maturity in reading is achieved.

Preliminary to post-hoc comparisons, a significant F-value was found for the remaining comparisons independent of those tested by planned comparisons. Inspection of Table I, Remainder, reveals that the over-all F-test for "other comparisons" was significant ($p < .001$). Since the over-all F-test was found significant, any post-hoc comparisons were legitimate (Hays, 1963). It is not profitable to work out every conceivable comparison among the means and test each for significance; rather, the experimenter should come to tentative conclusions about where the large and interpretable effects lie (Hays, 1963).

A series of Scheffé post-hoc comparisons ($p < .05$) was made among modality variables with good and poor readers and real and pseudo-words combined. A refinement was then made by examining the modality variables separately for good and poor readers. A total of 18 comparisons was made, with 6 comparisons necessary for each category (over-all, good and poor).

It is evident from an inspection of Figure 1 that the v/v group was significantly different from all other groups on the over-all comparison. A hierarchy of performance (v/v, o/v, v/o, o/o) was discovered suggesting that conventional orthographic representation is a facilitative ingredient to the development of semantic relationships. The results are presented in Table II.

An inspection of the performance of good readers and poor readers by modality groups was conducted separately. For both specified groups the same hierarchy of performance as in the over-all comparison was revealed. However, the significant differences between groups were different. The results are presented in Tables III and IV.

For good readers no one group was significantly different from all

TABLE II. Summary of Post-hoc Comparisons for Modality, Over-all

	<i>Mean</i>	<i>o/v</i>	<i>Group v/o</i>	<i>v/v</i>
<i>Mean Group</i>		68.8	62.0	84.4
o/o	50.3	18.5*	11.7	34.1*
o/v	68.8		-6.8	15.6*
v/o	62.0			22.4*
v/v	84.4			

*Significant $p < .05$

TABLE III. Summary of Post-hoc Comparisons for Modality, Good Readers

	<i>Mean</i>	<i>o/v</i>	<i>Group v/o</i>	<i>v/v</i>
<i>Mean Group</i>		87.3	74.6	90.1
o/o	59.9	27.4*	14.7	30.2*
o/v	87.3		-12.7	2.8
v/o	74.6			15.5
v/v	90.1			

*Significant $p < .05$

TABLE IV. Summary of Post-hoc Comparisons for Modality Group, Poor Readers

	<i>Mean</i>	<i>o/v</i>	<i>Group v/o</i>	<i>v/v</i>
<i>Mean Group</i>		50.4	49.4	78.7
o/o	40.7	9.7	8.7	38.0*
o/v	50.4		-1.0	28.3*
v/o	49.4			29.3
v/v	78.7			

*Significant $p < .05$

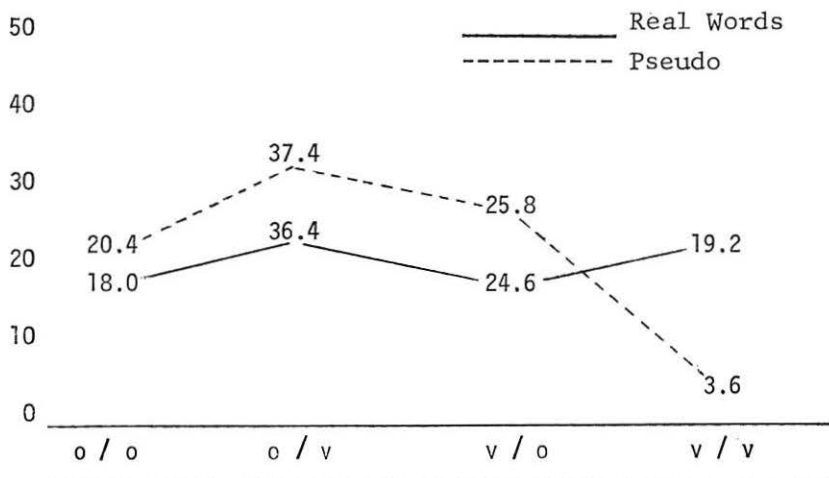


Figure 2. Difference of means of good and poor readers on real words and pseudo-words.

the others. Least differences appeared to be among the v/v, o/v, and v/o groups; none were significantly different from the others. For poor readers a different pattern of significant differences among groups was demonstrated. The v/v group was significantly different from all others. Least differences were observed among the o/v, v/o, and o/o groups, none of which were significantly different from any other.

Although good readers performed significantly better than poor readers on all four modality groups, it has been shown that performance on real words was significantly better than on pseudo-words in only three of the modality groups (o/o, o/v, and v/o). Also, it was observed in the post-hoc comparisons that the isolation of the reading ability factor resulted in a significant difference for the v/v group of poor readers, though not for good readers. The nature of the highly significant interaction is illustrated by the difference of the means of good and poor readers on real words and pseudo-words as illustrated in Figure 2.

The lower significant difference in scores observed in testing hypothesis 4 and the lack of a significant difference on hypothesis 8 seem attributable to this interaction. Poor readers in the pseudo-word, visual/visual cell responded to the treatment with better performance ($\bar{x} = 83.8$) than poor readers in the real word, visual/

visual cell ($\bar{x} = 73.6$). The results suggest that the visual/visual task was in substance different from the o/o, o/v, and v/o tasks as it did not necessitate the recognition of a deep structure. Poor readers were, hence, distinguished by this essential difference, while good readers were not significantly different in performance in this task than they were in the o/v and v/o tasks.

Conclusions and Implications

On the tasks which required recognizing regularities on a deep level (o/o, o/v, and v/o), good readers performed better than poor readers at a significant level ($p < .0005$). Also, good readers in the o/v task appeared to utilize the "common item" cue system which underlies conventional orthography, whereas, poor readers did not to a significant level.

The implication is that good readers are more competent in recognizing the underlying forms of words. By their knowledge of the phonological rules of the language and of the "morphophonemic" nature of the orthography, good readers (more than poor readers) in grade five were able to bypass the grapheme/phoneme correspondences and to relate the surface structures of words phonologically and orthographically to deep structures. The functional stimuli for the good readers appears to be the underlying form of lexical items; that is, a search for the semantic correspondence in derived words seems existent in the good readers. Neisser (1967) contends that word perception is a constructive synthetic activity. With the good readers a cognitive process of searching for deep structure is, therefore, apparent.

The results support a differential search pattern clarified by the effect of learning set upon problem-solving. When an individual experiences success with a particular method in problem-solving situations, he is apt to persist with that method even when it is inappropriate to new problem-solving situations (Klausmeier and Ripple, 1971). Readers who cling to the alphabetic principle encounter problems of efficiency since conventional orthography is not based on that single foundation. "In order to progress to more complex stages of reading, the child must abandon this early hypothesis, and come eventually to interpret written symbols as corresponding to more abstract lexical spellings. Normally he is able

to make this transition unaided as he matures and gains experience both with the sound structure of his language and with reading. It may be, however, that the difficulty encountered by some poor readers is related to the fact that they have not made this crucial transition [C. Chomsky, 1970, p. 297].”

Visual featural information shared by the graphic structural similarity in the v/v task clearly provided an analogic cue to semantic correspondence—this effect being especially pronounced by the performance of the poor readers. In terms of visual processing alone, good readers and poor readers are noticeably less different than perhaps previously thought. That is, when semantic correspondences are provided by visual features only, the analogic cue system is utilized by both good and poor readers as a facilitative cue in the identification of lexical relationships. However, when changing phonological properties are introduced, semantic correspondence is dependent upon the recovery of deep structure by underlying representation for analogy and the two groups, good readers and poor readers, performed differently.

It is suggested, therefore, that good readers have developed the strategy of attending to lexical identification (a search for meaning) rather than one of focusing upon surface structure. In this sense the perceptual construction of a word may be considered a more efficient search technique as it corresponds more closely to the higher order of complexity which exists in the English orthographic system. The “morphophonemic” nature of conventional orthography appears to be a more efficient system than one of “phonemic approximation” once some maturity in reading is achieved. The system exists as a practical means of identifying semantic relationships by the “elimination of redundant variation [Read, 1971, p. 24].”

The pedagogical implications of these findings for the field of reading suggest that children must learn the phonological rule system of English and must learn to relate such phonological knowledge to orthographic representation. Teachers need not be expected to fully understand competence models of the language for effective teaching in this area. It is obvious that so little is understood about the relationship of phonological knowledge and the interpretation of written symbols that a psychologically valid description is presently difficult.

However, it should be understood that oral language development is intimately related to reading ability. Assessments of readiness to read should include phonological performance, as well as assessments of disabled readers. A practical and easily constructed task may ask students to produce and/or recognize derived words after exposure to the theme form.

To facilitate the abstract relationship between phonological knowledge and the orthographic system, it must also be recognized that the orthography is not a system which relates grapheme to phoneme directly. The indirect relationship may then be illustrated by samples reflecting morphophonemic alternation to indicate that the appending of suffixes does not destroy a word to the creation of a totally new one, but, rather, it provides a method for using the represented concept as a different part of speech. While the semantic relationship is made, so should the orthographic one. An over-emphasis upon the alphabetical aspect of orthography may in fact serve to retard or curtail the necessary individual growth toward an understanding of the more sophisticated nature of the language system.

A useful strategy to prepare students for the changing utility of word recognition would be to prepare them with a set to search for the most economic stimulus held by an orthographic representation. Hereby, reading may be approached more reasonably as a problem-solving situation involving search and testing rather than a mere focus upon surface structure.

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APPENDIX A Sample Target Words by Alternation Type

REAL WORDS

s/ʒ

discuss/discussion
suffice/sufficient
commerce/commercial
repulse/repulsion
grace/gracious

Sample Sentence Context

- #41. discuss
S. To *discuss* a topic is to talk about it.
R. If a group of students talked about a topic, it would be a *discussion*.

Sample Response Alternatives

<i>Theme Form</i>	<i>Oral Alternatives</i>	<i>Visual Alternatives</i>
#41. discuss	a. dɪskʌʒən b. dɪskʌtən c. dɪskʌsən d. dɪskʌkən	a. dɪskʌʒən b. dɪskʌʒən c. dɪskʌʒən d. dɪskʌʒən

PSEUDO-WORDS

s/ʒ

lemace/lemacious
koness/konession
renulse/renulsion
dillerce/dillercial
plorice/ploricient

Sample Sentence Context

- #62. lemace
S. To be *lemace* is to be groggy and unaware.
R. A person who is groggy and unaware when he gets up is *lemacious*.

Sample Response Alternatives

Theme Form

#62. lemace

Oral Alternatives

- a. ləmesəs
- b. ləmekəs
- c. ləmetəs
- d. ləmešəs

Visual Alternatives

- a. lemazious
- b. lemashious
- c. limashus
- d. lemacious