

## *Reading, Writing, and Phonology*

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*The author discusses the relation of conventional English orthography to the sound structure of the language, showing that this relation is much closer than is ordinarily assumed. She points out that many of the non-phonetic aspects of English spelling are motivated rather than arbitrary, in that they correspond to a level of representation within the phonological system of the language which is deeper than the phonetic level. Finally she considers the implications of this view of the orthography for reading and spelling.*

The inconsistencies of English spelling are often a source of regret to the reading teacher and to those concerned with reading in general. Because English spelling is frequently not phonetic, because of the large number of words which are lacking in grapheme-phoneme correspondence, it is often concluded that the orthography is irregular and a relatively poor system for representing the spoken language. While it is true that English spelling in many instances is deficient as a phonetic transcription of the spoken language, it does not necessarily follow that it is therefore a poor system of representation. This paper discusses a far more positive view of English orthography which has emerged from recent work in phonological theory within the framework of transformational grammar.



① vowel alternations

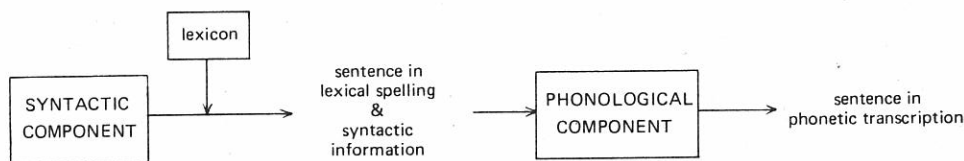
are added to them: e.g., the [ey]—[æ] alternation in *nation-national*, *nature-natural*, *sane-sanity*. These pairs of words, because of the vowel alternation, would have to receive two spellings each in a "phonemic" lexicon, each member of the pair constituting a separate lexical item. That is, one spelling would be needed with [ey] for the word in isolation: *nation*, and another with [æ] for the stem to which certain suffixes are added: *nation*, *-al*, *-ality*, *-alistic*, etc.

Now these [ey]—[æ] alternations, as it happens, are not isolated cases or irregular occurrences. This type of vowel alternation is very common in English and takes place under specifiable conditions of great generality and wide applicability. It is in fact an integral feature of the phonological system of the language which speakers of English have internalized and which they use automatically in producing and understanding utterances. For we find that the same principles which govern the [ey]—[æ] alternation cited govern also other vowel alternations, such as the [iy]—[e] alternation in *extreme—extremity*, *convene-convention*, the [ay]—[ɪ] alternation in *expedite-expedition*, *wide-width*, and the [o]—[ɑ] alternation in *phone-phonetic*, *compose-composite*.

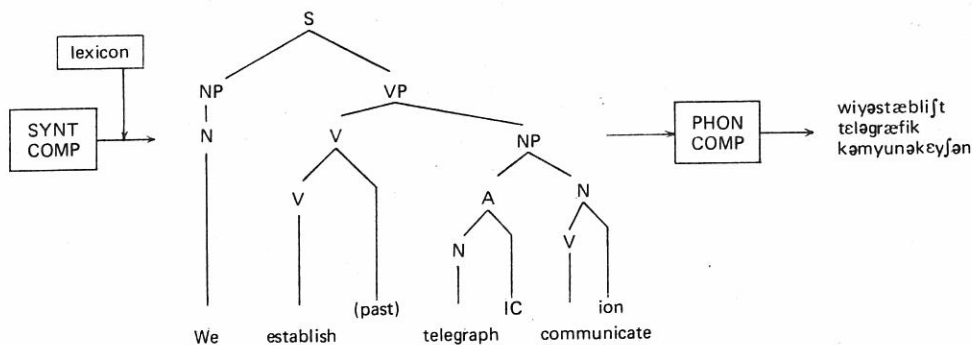
Word pairs such as these, though phonetically different, are recognized by speakers of the language as variant forms of the same word. It is revealing, therefore, when designing the grammar's lexicon, to postulate just one lexical spelling for the vowel, and then to state the general principles which apply to this one shared vowel to produce the two different vowels actually present in the pronunciations of the words. The lexical spelling thus acquires the character of an abstract representation, from which the actual phonetic realizations are predictable according to general rules of pronunciation.

This dual feature, of abstract spelling and rules for converting to pronunciation, is a highly desirable feature of a grammar. Among other things, it retains in the lexical spelling similarities which are real in the language. *Nation* and *national* are not different words in the sense that *nation* and *notion* are different words. They are different forms of the same word. For the lexical spelling to capture this sameness, in spite of surface phonetic differences, is highly desirable. Of course this sameness is exactly what is captured by conventional English orthography in the examples above, where the alternations presented are the familiar long-short vowel alternations. From this viewpoint, this divergence of the conventional orthography from phonetic transcription appears well motivated. It offers the advantage of expressing an underlying reality of the language which is masked by surface phonetic features.

In order to clarify the role of the lexical spelling of words within a transformational grammar, let me indicate what place this abstract entity occupies in the grammar. I have said that the lexical spelling is the way words are spelled in the grammar's lexicon. The other components of the grammar that concern us here are the syntactic component and the phonological component. The syntactic component consists of phrase structure rules and transformational rules. Its output is, among other things, a sentence whose syntactic structure is indicated (see diagram below), in which the words are represented in their lexical spelling, just as they come from the lexicon. It is this string of words, together with information about their syntactic structure, that serves as input to the phonological component. The phonological component in its turn is a complex system of phonological rules that apply to this string and convert it into a phonetic representation. This sequence may be diagrammed thus:



The sentence "We established telegraphic communication," for example, would assume the following forms in the above sequence of operations:



The phonological component contains rules that operate on the lexical spellings, taking into account their syntactic environments, in order to produce a phonetic representation. These are rules that place stress where it belongs, that introduce phonetic effects such as palatalization, velar softening, spirantization,

voicing, diphthongization, and so on. In the phonetic system of the language. Their phonetic realization in their syntactic context occurs in speech.

In producing and interpreting speech, the speaker operates with rules such as those mentioned above. He is not aware of them any more than he is of the rules of grammar. It is able him to produce a sentence in the course of acquiring his phonetic system, and as a matter of fact, in speaking and in comprehension.

Among the interesting questions in grammar is the question of the relationship between lexical spelling and what should be the necessary phonetic output corresponding to it. One of the principles of information and operations that must be adhered to is that phonetic realization of a word is predictable by generalization from the phonological rules discussed above: it is sufficient to use only the phonological rules to shorten the word. Although the vowel system of the lexicon or by the phonological rule, as mentioned above, the sameness of the vowel, as in the word 'language'.

Consider also the correlation between the phonetic variations in the word 'anxious/anxiety', or the phonetic variations in the word 'anxious/anxiety'. The lexical spellings can ignore the phonetic component. Of course, there are good examples of cases where the phonetic realization is directly identified with the lexical spelling, as in the word 'anxious/anxiety' to abstract away from in

voicing, diphthongization, vowel reduction, vowel shift, laxing and tensing of vowels, and so on. In short, all the rules that make up the phonological system of the language. Their role is to operate on abstract lexical representations within their syntactic context in order to produce the phonetic forms that actually occur in speech.

In producing and interpreting speech, a speaker of the language constantly operates with rules such as these. Certainly he has no conscious knowledge of them any more than he has conscious knowledge of the syntactic rules which enable him to produce and understand sentence structures in his language. In the course of acquiring his language he has internalized the rules of its phonological system, and as a mature speaker he operates in accordance with them both in speaking and in comprehending the spoken language.

Among the interesting decisions that have to be made when designing the grammar is the question of what information properly belongs in the lexical spelling and what should be introduced by the phonological rules. The necessary phonetic output could be achieved with a number of different distributions of information and operations within the grammar. In general, the principle adhered to is that phonetic variation is not indicated in the lexical spelling when it is predictable by general rule. All such predictable phonetic information is left to the phonological rules. As an example, consider the long-short vowel alternations discussed above: *nation-national*, *wide-width*, *phone-phonetic*, etc. It is sufficient to use only the long vowel in the lexicon, and to leave it to the phonological rules to shorten this vowel automatically in the presence of certain suffixes. Although the vowel shift could theoretically be introduced either in the lexicon or by the phonological rules, it is preferable to introduce it by phonological rule, as mentioned, for the double reason of expressing the underlying sameness of the vowel, and generality of the feature of vowel shift within the language.

Consider also the common items of words such as *courage/courage-ous*, or *anxi-ous/anxi-ety*, or *photograph/photograph-y/photograph-ic*. Although the phonetic variations are considerable, they are perfectly automatic, and the lexical spellings can ignore them. They will be introduced by the phonological component. Of course, the conventional orthography ignores them as well. These are good examples of cases where the conventional orthography, 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. Conventional orthography has

itself abstracted away from the phonetic details, and presents the lexical item directly, as it were.

Now it is a feature of English that it has a rich system of phonetic variations which function very much like the vowel alternations discussed. That is, English has many kinds of surface phonetic variations which need not, and preferably ought not, be represented in the lexical spelling of words. They are wholly predictable within the phonological system of the language, and are therefore best introduced within the grammar by means of automatic phonological rules. As with vowel alternation, these other variations obscure an underlying sameness which the lexical spelling is able to capture. And as with vowel alternations, these surface phonetic variations are not reflected in the conventional orthography.

Consider, for example, the extensive system of consonant alternations in English which are surface phonetic variations only. These phonetic variants are expressed neither in the lexical spellings of words in the grammar, nor in the conventional orthography. Such consonant alternations are surprisingly common. Some examples are:

#### PHONETIC VARIANTS

#### SAMPLE WORD PAIRS

[k] — [s]

medicate—medicine  
critical—criticize  
romantic—romanticize

[g] — [dʒ]

sagacity—sage  
prodigal—prodigious

[d] — [dʒ]

grade—gradual  
mode—modular

[t] — [ʃ]

resident—residential  
expedite—expeditious

[t] — [tʃ]

fact—factual  
quest—question  
right—righteous

[z] — [ʒ]

revise—revision

[s] — [z]

sign—resign  
gymnastics—gymnasium

All of these phonetic variations are automatic and predictable within the phonological system of the language. They need not be represented in the lexical

spelling of the words, for language would be lost on the lexical level. Although being “unphonetic” in correspondence, the orthographic forms exist at a deeper level of reading easier.

Two other such surface alternations and consonant placement and vowel reduction in the lexical spelling of words in orthography also fails to reflect primary stress and the fact that vowel reduction is a phonological fact that [ə] in unstressed position.

Take, for example, the word *telegraphic*, primary stress on the second syllable. Since this is not an unusual word, it is pressed on a lexical level. It is left to the phonologist to explain the alternations.

Consider also the phonetic forms above assume the following:

a) tele

b) tele

c) tele

In a) and b) the second syllable is predictable nature of the word. The following passage from *The*

It is quite obvious... that the three forms of *telegraph*

<sup>a</sup> Chomsky and Halle, *op. cit.*,

spelling of the words, and indeed, underlying similarities which are real in the language would be lost in the grammar if these differences were to be represented on the lexical level. And the same is true of the conventional orthography. By being "unphonetic" in all of these cases, by not exhibiting grapheme-phoneme correspondence, the orthography is able to reflect significant regularities which exist at a deeper level of the sound system of the language, thus making efficient reading easier.

Two other such surface phonetic variations of English, in addition to vowel alternations and consonant alternations, are the interrelated features of stress placement and vowel reduction. Again, these two features are not reflected in the lexical spelling of words because they operate predictably according to rule. The orthography also fails to record them. Surprising as it may seem, the placement of primary stress and the varying degrees of lesser stress in English works largely according to phonological rule, given the lexical spellings of words and information about the syntactic structures in which they appear. Less surprising is the fact that vowel reduction, the pronunciation of certain vowels as a neutral schwa [ə] in unstressed positions, takes place according to rule.

Take, for example, the word *telegraph*. It is stressed on the first syllable. In *telegraphic*, primary stress shifts to the third syllable, and in *telegraphy*, to the second syllable. Since this is a regular variation which many lexical items undergo, and not an unusual feature of this particular word, none of this need be expressed on a lexical level, nor is it expressed in the conventional orthography. It is left to the phonological component of the grammar to introduce these variations.

Consider also the phenomenon of vowel reduction in this same word. The above forms assume the following phonetic shapes in speech:

- |                |              |     |
|----------------|--------------|-----|
| a) telegraph   | [tɛ lə græf] |     |
| b) telegraphic | [tɛ lə græf] | -ic |
| c) telegraphy  | [tə lé grəf] | -y  |

In a) and b) the second vowel is reduced; in c), the first and third vowels. The predictable nature of these variations is discussed by Chomsky and Halle in the following passage from *The Sound Pattern of English*.<sup>3</sup>

It is quite obvious . . . that this phonetic variation (of stress shift and vowel reduction in the three forms of *telegraph*) is not fortuitous—it is not of the same type as the variation

<sup>3</sup> Chomsky and Halle, *op. cit.*, pp. 11-12.

between *I* and *we*, which depends on specific assignment of the latter to the category of plurality. Given the grammar of English, if we delete specific reference to the item *we*, there is no way to predict the phonetic form of the plural variant of *I*. On the other hand, the rules for English grammar certainly do suffice to determine the phonetic variation of *telegraph* without specific mention of this lexical item, just as they suffice to predict the regular variation between *cat* and *cats* without specifically mentioning the plural form. It is quite obvious that English grammar is complicated by the fortuitous variation between *I* and *we* but not by the totally predictable variation between *cat* and *cats*. Similarly, the grammar would be more complicated if *telegraph* did *not* undergo precisely the variation in (a)-(c); if, for example, it had one phonetic form in all contexts, or if it had the form (a) in the context -ic, (b) in the context -y, and (c) in isolation.

Once again, surface phonetic variations which are automatic and which obscure similarities in lexical items are not represented at the lexical level (or in the orthography), but are introduced by the phonological component of the grammar.

I have referred several times to the abstract nature of the lexical spellings in the grammar. Now that a number of examples have been given, this abstract character of the lexical level becomes clearer. In the lexical spelling, many predictable phonetic features of the spoken language are suppressed, e.g., vowel alternations, consonant alternations, schwa, stress, and others that I have not gone into. The lexical spelling, and the conventional orthography which corresponds so closely to it, abstract away from these variations in pronunciation and represent deeper similarities that have a semantic function in the language. The lexical items are, after all, the meaning-bearing items in the language. Lexical spellings represent the meaning-bearing items directly, without introducing phonetic detail irrelevant to their identification. Thus on the lexical level and in the orthography, words that *are* the same *look* the same. In phonetic transcription they look different. In reading, one is very likely aided by this feature of the conventional orthography. It permits reading to occur with more efficiency. That is, the spelling system leads the reader directly to the meaning-bearing items that he needs to identify, without requiring that he abstract away from superficial and irrelevant phonetic detail. In speech, on the other hand, one operates on both the abstract and the phonetic levels, with the phonological rules mediating between the two.

It seems also that this abstract lexical level is highly resistant to historical change, and remains the same over long periods of time. Pronunciation shifts that occur as a language changes over time appear to be the result of changes in

phonological rules rather than in the lexicon. For this reason a stable orthography is possible. In this way a language can maintain differences also stem from differences in lexical spelling. Orthography is a reasonably stable feature of American English, and it varies from country to country and around the world.

Given that lexical spellings are one of the ways just illustrated, it is obvious that they have for speakers of a language a function in the system. Are these abstract spellings merely conventionalized linguistic poses of his grammar, or do they represent a user? In other words, is there something real in the linguistic knowledge that can honestly be said to be represented by the spelling system?

It seems to me that the corresponding aspect of the language user is the orthography. For the language user, the orthography is a set of readers, so let me be very clear. The orthography is a "common item" of words such as *critic-al/critic-al*. There are many common items. There are many related. But clearly what is represented by the phonetic representation is the orthography.

phonological rules rather than changes in the lexical spellings themselves. For this reason a stable orthography remains effective over time in spite of changes in the way a language is pronounced. And it appears that a wide range of dialect differences also stem from adjustments of phonological rules rather than differences in lexical spellings. This would explain why conventional English orthography is a reasonably adequate system of representation for both British and American English, and the vast range of English dialects that exist within each country and around the world.

Given that lexical spellings differ from phonetic representations in the numerous ways just illustrated, the question naturally arises what implications this may have for speakers of the language and their internal organization of its sound system. Are these abstract lexical representations that are postulated by the linguist merely convenient fictions that the linguist manufactures for the purposes of his grammar, or do they have a psychological reality for the language user? In other words, is the claim that the orthography corresponds to something real in the linguistic knowledge of the reader based on anything that the reader can honestly be said to know?

It seems to me that in a very real sense the lexical level of representation and the corresponding aspects of English orthography do have a psychological reality for the language user. I realize that this assertion will be troublesome to many readers, so let me be very specific about what I mean. I spoke above of the "common item" of words such as *anxi-ous/anxi-ety*, and *courage/courage-ous*. Pairs such as *critic-al/critic-ize*, *revis-e/revis-ion*, *illustrat-e/illustrat-ive* also contain common items. There is little question that speakers recognize these words as related. But clearly what is common to these pairs is not their *surface* form, their phonetic representation, for they are pronounced differently:

anxi - ous : [æŋkʃ]  
 anxi - ety : [æŋgzəy]  
 courage : [kʌrədʒ]  
 courage - ous : [kərəydʒ]  
 critic - al : [krɪtɪk]  
 critic - ize : [krɪtɪz]  
 revis - e : [rɪvəyz]  
 revis - ion : [rɪvɪʒ]  
 illustrat - e : [ɪləstreɪt]  
 illustrat - ive : [ɪləstrət]

What is common to them, as was shown earlier, is their *underlying* form, their lexical spelling, which the orthography corresponds to quite closely. To say that this form has psychological reality is to say only that this common item is recognized by the language user *as a common item*, and that its different phonetic realizations are regular within the sound system of the language. The variations in the pairs listed above are not idiosyncratic within the grammar, as is for example the variation between *woman* and *women*, but take place according to general phonological rule. These variations are automatic and do not complicate the grammar in any way. Indeed they would complicate the grammar if they did *not* occur precisely the way they do.

To look at it another way, one might consider, for example, the status of the [k]-[s] alternation in *kill/sill* as compared to *medicate/medicine*. The difference in status can readily become clear to one who knows the language. In *kill/sill* the phonetic change from [k] to [s] creates a new lexical item. It is both a phonetic and a lexical change. But in *medicate/medicine* it is a phonetic change only. The lexical item remains the same, as does the lexical spelling and the orthography. A speaker who is not aware of this differing status of the two [k]-[s] alternations can have the difference brought to the level of awareness without difficulty, because it reflects a fact about his language that he uses continually, and that is far more general than this one example. In order to become aware of this fact he does not need to be taught it, as a foreigner learning English would, but merely to have it brought to his attention.

The implications of this view of English orthography with regard to reading are several. First, it implies 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 written symbol to the abstract lexical spelling of words. Letters represent segments in lexical spelling, not sounds. It is the phonological rule system of the language, which the reader commands, that relates the lexical segments to sounds in a systematic fashion.

Stated somewhat differently, the mature reader does not proceed on the assumption that the orthography is phonetically valid, but rather interprets the written symbols according to lexical spellings. His task is facilitated by the fact that the orthography closely corresponds to this lexical representation. He does not need to abstract away from unnecessary phonetic detail to reconstruct this lexical representation as would be required if the English spelling system were phonetically based. What he needs to identify are the lexical items, the meaning-

bearing items, and the based orthography.

It is highly likely that does assume that the o nunciation. In order to abandon this early hyp as corresponding to m this transition unaided structure of his langua encountered by some p this crucial transition. that this is indeed a fa can be raised, namely l achieved it on their own

Most methods of tea to this shift in emphasis system. Beginning reac sounds, whether it is method, tends to treat and phonetic inaccura by means of letter-soun expected to apply their task. They learn to de nothing of English pho is meant to be a direct vision is made at any p realistic view of spellin lexical similarities. It w count in dealing with r phasis ought to be shi sideration of the underl to this shift in emphas more heavily on phono more efficiently.

In practice, this coul dren, and bringing out

bearing items, and these are quite readily accessible to him from the lexically based orthography.

It is highly likely that the child, however, in the beginning stages of reading, does assume that the orthography is in some sense "regular" with respect to pronunciation. 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. This question should be amenable to study. If it appears that this is indeed a factor for some poor readers, then a second related question can be raised, namely how to encourage this progress in children who have not achieved it on their own.

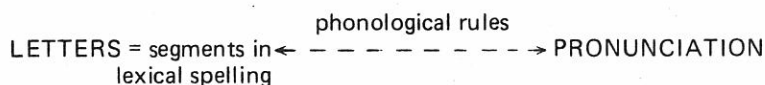
Most methods of teaching reading have little or nothing to offer with respect to this shift in emphasis from a phonetic to a lexical interpretation of the spelling system. Beginning reading instruction that deals analytically with letters and sounds, whether it is based on phonics, the linguistic method, or any other method, tends to treat phonetically accurate spellings as regular in the language, and phonetic inaccuracies as irregular. Children translate spellings into sounds by means of letter-sound correspondences or spelling patterns without ever being expected to apply their knowledge of the phonological system of English to the task. They learn to decode written English much as a foreigner would who knows nothing of English phonology. The child thus gains the impression that spelling is meant to be a direct representation of the pronounced form of words. No provision is made at any point for having him revise this notion in favor of a more realistic view of spelling regularity based on word relationships and underlying lexical similarities. It would seem wise to take this view of regularity into account in dealing with reading beyond the introductory stages. At some point emphasis ought to be shifted away from the phonetic aspects of spelling to a consideration of the underlying lexical properties of the orthographic system. Crucial to this shift in emphasis is the expectation that the child will rely more and more heavily on phonological processing as he learns to decode written English more efficiently.

In practice, this could take the form of discussing "word families" with children, and bringing out the variety of pronunciations associated in a regular way

with individual spellings. As soon as the children's vocabulary permits, they could take up words like *major-majority*, *history-historical-historian*, *nature-natural*, etc., to see how one and the same root changes its pronunciation as different endings are added to it. They might even profitably be introduced to the idea of the abstractness of spelling by considering that the root alone doesn't really have a specific pronunciation until you know what ending goes with it. For example, *natur-* and *histor-* are recognizable roots, but they need to have endings before you can tell which pronunciation is intended.

In this connection it might be helpful if the teacher of reading were aware that words whose spelling is phonetically accurate do not constitute a distinct and meaningful category in the language. They are not the only systematically spelled words in the language, as is often believed. All words whose conventional spelling is close to their abstract lexical spelling are spelled systematically, and this is the more meaningful category. Within this larger category are words whose spelling is close to pronunciation, and many whose spelling is more distant from pronunciation. The former are phonetically spelled words such as *mat* and *pin*, and the latter are words such as *explanation*, *courage*, and *resign* which require more extensive phonological processing. The important point is that they are all spelled systematically, given the sound structure of English. Exceptions are words which fall outside the system, i.e., whose conventional spelling displays aspects which bear little relation to their abstract lexical spelling and which appear unmotivated and arbitrary from a phonological point of view. These are words such as *freight*, *sword*, *guard*, and the like.

It is of interest to realize that the child, when he learns to read, is not being introduced to a system of representation that is inconsistent with the language that he speaks. It is simply that the orthography bears an *indirect* rather than a direct relation to his pronunciation. The direct correlation is to lexical spelling, a level of linguistic processing that is beneath the surface, related to pronunciation by regular phonological rules that are part of the child's normal linguistic equipment. This correspondence can be diagrammed as follows:



Letters correspond to segments in lexical spelling, which in turn are related to pronunciation through the medium of the phonological rules. The correspon-

dence is to something to handle. It is because it is superficially apparent.

To make this point clear for an adult in reading, for example, is convertible in on the first syllable, less reduced second vowel, a. The adult speaker of English tends to recognize the letters then to superimpose all the cause he knows the language written suffix -y to this form superimposes is radical third syllables unstressed second vowel. He converts cause of phonological knowledge because of anything that told how to apply stress ready knows.

On the other hand, the elementary letter-sound to do this. Knowing not very different position with necessary information about pronounce *photograph* what the child already knows that relate underlying reality has no awareness of this level of awareness. But it cally and enables English sense tells them what they

The ability of the child should increase naturally comes more familiar with full phonological system cabulary including Latin

dence is to something real in the child's linguistic system that he is equipped to handle. It is because it is one step removed from his pronunciation that it is not superficially apparent.

To make this point clearer, consider the role that knowing the language plays for an adult in reading English aloud. The written form *photograph*, for example, is convertible into a particular phonetic configuration, with primary stress on the first syllable, lesser stress on the third syllable, second syllable unstressed, reduced second vowel, and full vowel quality expressed by the first and third vowel. The adult speaker of English is able to utilize elementary letter-sound correspondences to recognize the basic morphological components of the word, *foto-graf*, and then to superimpose all the above phonetic information on these components *because he knows the language* and can apply its phonological rule system. Add the written suffix *-y* to this form: *photography*, and the phonetic information which he superimposes is radically different: primary stress on second syllable, first and third syllables unstressed, reduced first and third vowels, full vowel quality of second vowel. He converts to different phonetic configurations in the two cases *because of phonological knowledge which he brings to the reading situation, not because of anything that is explicit in the orthography*. He does not have to be told how to apply stress and change vowel quality in these forms because he already knows.

On the other hand, a foreigner who knows no English but has learned the elementary letter-sound correspondences of the English alphabet will be unable to do this. Knowing nothing of the language, such a foreigner finds himself in a very different position when he tries to pronounce these two words. Lacking the necessary information about English phonology, he will read phonetically, and pronounce *photograph* alike in both contexts. What the foreigner lacks is just what the child already possesses, a knowledge of the phonological rules of English that relate underlying representations to sound. To be sure the child (or adult) has no awareness of this knowledge, and would be hard pressed to bring it to the level of awareness. But of course there is no need to do so. It works automatically and enables English speakers to manage well with an orthography that in a sense tells them what they need to know and leaves the rest to them.

The ability of the child to interpret the orthography directly at the lexical level should increase naturally as his phonological competence increases and as he becomes more familiar with the relations expressed by the spellings of words. The full phonological system of English depends heavily on a learned stratum of vocabulary including Latinate forms and a network of affixes which account for

a large portion of surface phonetic variations. As the maturing child comes to control these forms in the spoken language he internalizes both their underlying representations and the phonological rules which relate the latter to pronunciations. This process of internalization depends in part on recognizing the relevant similarities in words which are pronounced differently. It is no doubt facilitated in many cases by an awareness of how words are spelled. Thus the underlying system which the child has constructed from evidence provided by the spoken language and which contributes to his ability to interpret the written language may itself be improved by his increased familiarity with the written language.

Another aspect of progress in reading relates to the freedom that the reader has, given the lexical nature of the orthography, to avoid phonological processing as he reads. Earlier I pointed out an advantage of the lexically based orthography: the reader does not have to abstract away from unnecessary phonetic detail to reconstruct the lexical representation of words. It is also true that he does not have to carry out the inverse activity. He does not have to construct phonetic forms from the underlying lexical forms presented by the orthography. Silent reading may take place primarily at the lexical level, without requiring the experienced reader to convert to the surface phonetic level. If he wishes to convert to phonetic representation, as for example in reading aloud, he does so through the automatic application of the phonological rules of the language. But this phonological processing may be minimal in rapid silent reading. Indeed, it may be that part of learning to read rapidly and well is learning to dispense with the application of phonological rules. Experienced readers probably engage in varying degrees of phonological processing depending on the type of material they are reading and the reading speed they employ at any given time. But they have learned how to dispense with a good deal of the phonological processing when they wish to. Less skilled readers may not have acquired this ability. Children probably do pronounce to themselves while they are still inexperienced at reading, and only later begin to be able to relinquish this phonological processing. It is likely that with increasing experience they gradually come to exploit the lexical nature of the orthography more and more effectively. Certainly there would seem to be no need to deal with words at the surface phonetic level, given an orthography that directly represents the underlying form of words. Children's reading, therefore, ought to improve as the amount of phonological processing that they engage in decreases.

From this point of view, reading aloud would seem to be of questionable value in improving silent reading. In the very early stages of reading, when the child

reads primarily phonetically and oral reading is the child progresses directly from these lexical representations without converting these lexical forms to surface phonetic forms. At this point would be pointed out above, completely. By the nature of the orthography, But reading aloud does not require the experienced reader to engage in the mental activity of pronouncing what he has read. Thus, in silent reading, processing as in silent reading. Since phonological processing is a part of the reading process, it would seem that they are finally beginning oral reading for its own sake. It should keep in mind the positive effect on the child's ability to persist in reading behind.

An interesting and important question is the structure and reading speed of the phonological system. It is most likely, that full orthography is not yet acquired fairly late. C

The conventional orthography is to be optimal for the so-called phonological system. The evidence that determines the system is based on considerations by no means obvious that may not yet have been of this system. . . . It would

<sup>4</sup> Chomsky, N., *op. cit.*

reads primarily phonetically, there is probably little difference between the two, and oral reading is useful as a check on what the child is actually doing. But as the child progresses to the point where he begins to interpret lexical representations directly from the orthography, he ought to be encouraged to give up converting these lexical representations to phonetic ones. Phonological processing at this point would be a hindrance rather than a help. Skilled silent reading, as pointed out above, can bypass the phonological rules to some extent or even entirely. By the nature of the orthography it never needs to bring them into play. But reading aloud does require their full application. Reading aloud burdens the experienced reader doubly. It is not only that he has to engage in the motor activity of pronouncing what he has read. In order to pronounce it, he must first engage in the mental activity of determining the full phonetic characteristics of what he has read. That is, instead of performing a minimum of phonological processing as in silent reading, he must perform the maximum when reading aloud. Since phonological processing is essentially extraneous to the mature reading process, it would seem ill-advised to focus children's attention on it when they are finally beginning to read "lexically." The teacher may wish to develop oral reading for its own sake, of course, independent of silent reading. But she should keep in mind the possibility that practice in oral reading may have little positive effect on the child's abilities in silent reading, and may even encourage him to persist in aspects of unskilled silent reading that he ought to be leaving behind.

An interesting and important question which is raised by this view of sound structure and reading concerns the age at which the child achieves a mature command of the phonological structure of his language. It is quite possible, perhaps most likely, that full knowledge of the sound system that corresponds to the orthography is not yet possessed by the child of six or seven, and may indeed be acquired fairly late. Chomsky puts it this way:<sup>4</sup>

The conventional orthography corresponds closely to a level of representation that seems to be optimal for the sound system of a fairly rich version of . . . spoken English. Much of the evidence that determines, for the phonologist, the exact form of this underlying system is based on considerations of learned words and complex derivational patterns. It is by no means obvious that a child of six has mastered this phonological system in full. He may not yet have been presented with the evidence that determines the general structure of this system. . . . It would not be surprising to discover that the child's intuitive organi-

<sup>4</sup> Chomsky, N., *op. cit.*

zation of the sound system continues to develop and deepen as his vocabulary is enriched and as his use of language extends to wider intellectual domains and more complex functions. Hence the sound system that corresponds to the orthography may itself be a late intellectual product.

A serious possibility, following from these hypotheses, is that one of the important ways to improve reading might be to enrich the child's vocabulary so as to enable him to construct for himself the underlying representations of sound that correspond so closely to the written form. As far-fetched as this possibility may seem at first, it ought to be given serious consideration in light of the close tie that exists between English phonology and English orthography. The orthography assumes a fairly sophisticated degree of internal organization of the sound system of the language. Extending the child's vocabulary to include Latinate forms and polysyllabic derived forms is one of the best ways to provide him with the means of constructing the phonological system of his language more fully as he matures. He ought to become familiar with word groups such as *industry-industrial, major-majority, history-historical-historian, wide-width, sign-signature*, etc., and have their relationships made explicit for him. In general, connections should be brought out among words that he already knows but may not yet have classified together, and new words should be introduced for the purpose of establishing new connections. His awareness of these relationships and the variant phonetic forms that words assume in different contexts will facilitate and accelerate his internalization of the phonology of his language.

Literacy acquisition from this point of view may well extend over a much longer period of time than ordinarily assumed, and be closely interrelated with these other aspects of the child's linguistic development. Although little is known at the present time about the child's acquisition of these deeper aspects of the sound structure of English, it is certainly likely that it continues well into the school years. It would be interesting to try to assess the child's implicit knowledge of this phonological system at various stages of his development. An attempt might also be made to determine the degree to which advances in reading ability form part of this same process of development. It would not be at all surprising, perhaps for adults as well as children, if those who control the sound system of English better also exploit its orthography more effectively.

Spelling is another area of interesting practical application of this view of the orthography. In the case of spelling it seems to me that the major contribution might be to the teacher's own assumptions about the orthography. If she works

on the assumption that *sense*, she will encourage do exist. If she is familiar but basically she and armed primarily with and the recognition to great deal to recommen

To start, there are q need help, so that the on their own. Good words are spelled alike to rely on an underlying pronunciations. And habit of automatically deal in their pronunciation. When they are not sure do is bring to mind of the solution. If it is a stressed variant of the no way to guess the second but thinking of *industry* deduced vowels.

After all, how *do* *w* and *adoration* are written. Obviously because of the spellings of *de* make the connection clear, the correct spelling

If the child develops related words that settle but in the long run he ties of the orthography other, he equips himself of vocabulary.

The examples which be constructed to bring

on the assumption that spelling corresponds to something real, *that it makes sense*, she will encourage the child to recognize and exploit the regularities that do exist. If she is familiar with some of the more obvious regularities it will help, but basically she and the children can work together to characterize regularities, armed primarily with their joint knowledge of the language as native speakers, and the recognition that the conventional spelling system does in fact have a great deal to recommend it.

To start, there are quite specific things that can be pointed out to children who need help, so that they may approach the stage that good spellers seem to reach on their own. Good spellers, children and adults alike, recognize that related words are spelled alike even though they are pronounced differently. They seem to rely on an underlying picture of the word that is independent of its varying pronunciations. And when encountering a troublesome word, they are in the habit of automatically putting to use the idea that related words may vary a good deal in their pronunciation, but that the spelling by and large remains the same. When they are not sure how to spell a particular word, the first thing that they do is bring to mind other related words in the hope of finding one that contains the solution. If it is a reduced vowel that is causing the trouble, a differently stressed variant of the word will often provide the answer. For example, there is no way to guess the second vowel of *industry* from the pronunciation of the word, but thinking of *industrial* solves the problem. And this is often the case with reduced vowels.

After all, how *do* we know that the second vowel of *declaration*, *inspiration* and *adoration* are written differently, when they are pronounced exactly alike? Obviously because of *declare*, *inspire*, and *adore*. We do not have to memorize the spellings of *declaration*, *inspiration*, and *adoration*, but merely be able to make the connection in each case to the related verb. Once the connection is clear, the correct spelling is automatic.

If the child develops the habit of seeking such connections, of thinking of related words that settle his spelling uncertainties for him, he not only spells better, but in the long run he familiarizes himself with the general underlying regularities of the orthography. Instead of memorizing individual words one after the other, he equips himself with the systematic means of dealing with large segments of vocabulary.

The examples which follow suggest several types of "spelling lessons" that can be constructed to bring out a number of these features of the spelling system.

These samples are intended primarily to indicate a general approach. In practice, of course, vocabulary would have to be adapted to the abilities of individual classes.

Children could be asked, for example, to fill in the missing reduced vowel in a list such as column (1), and then to justify their choices by thinking of related words which retain vowel quality. They would then produce something like column (2).

| (1)         | (2)                   |
|-------------|-----------------------|
| dem_cratic  | democracy             |
| pres_dent   | preside               |
| prec_dent   | precede               |
| comp_rable  | compare, comparison   |
| comp_sition | composer, compose     |
| hist_ry     | historical, historian |
| janit_r     | janitorial            |
| manag_r     | managerial            |
| maj_r       | majority              |
| ill_strate  | illustrative          |
| ind_stry    | industrial            |
| imm_grate   | migrate               |
| cons_lation | console               |
| ab_lition   | abolish               |
| comp_tent   | compete               |

Or, simply given column (2), they could be asked to think up other forms of the words, and to characterize the specific ways in which the vowel sounds shift around. Anything that focuses their attention on related words and concomitant pronunciation shifts ought to be good practice for finding specific related words when they need them.

This approach works not only for recovering the full form of reduced vowels, but often for selecting the correct consonant from a choice of two when pronunciation is ambiguous. For example, in column (1), the italicized consonant

could, given its pronunciation. The related word is

cri  
m  
na  
gr  
rig  
ra

Another helpful exercise but pronounced in other

(1)  
muscle  
sign, (de)  
bomb  
condemn  
malign  
soften

Children could be given the underlined consonant in column (1) and asked to recover phonetically and asked to name the (2) word can be elicited

The need for practice with children. This was brought about some of these silent letters intelligence but a poor

What letter is silent in the word *E*.

Ok, you're right. But how do you know? *I don't know. There is*

could, given its pronunciation, be written using either of the letters in parentheses. The related word in column (2) narrows the choice to just one of these.

| (1)               | (2)      |
|-------------------|----------|
| criticize (c, s)  | critical |
| medicine (c, s)   | medical  |
| nation (t, sh)    | native   |
| gradual (d, j)    | grade    |
| righteous (t, ch) | right    |
| racial (t, c, sh) | race     |

Another helpful exercise involves consonants which are silent in some words but pronounced in others. For example:

| (1)            | (2)                           |
|----------------|-------------------------------|
| muscle         | muscular                      |
| sign, (design) | signature, signal (designate) |
| bomb           | bombard                       |
| condemn        | condemnation                  |
| malign         | malignant                     |
| soften         | soft                          |

Children could be given column (2) and asked to think of related words in which the underlined consonant becomes silent. Or, conversely, they could be given column (1) and asked to think of related words in which the silent consonant is recovered phonetically. Or they could be given the words in column (1) orally and asked to name the silent consonant. For those who can't do it, the column (2) word can be elicited or, if necessary, pointed out as helpful evidence.

The need for practice in this sort of thinking seems to be quite strong for some children. This was brought home to me recently by a conversation that I had about some of these silent consonants with a seventh-grade girl, a child of average intelligence but a poor speller. The conversation went like this:

What letter is silent in the word "muscle"?

E.

Ok, you're right. But how about a *consonant* that's silent?

*I don't know. There isn't any.*

Well, how do you spell "muscle"?

*M-u-s-l-e*

There's something left out. What do you call a man who has a lot of muscles?

*Strong*

Yes, but what do you call him that's related to the word "muscle"?

*I don't know.*

Did you ever hear the word "muscular"?

*Yeah, I guess so.*

Well, how do you spell "muscular"?

*M-u-s-c-...*

That's all you need. So how do you spell "muscle"?

*M-u-c...*

Wait. How does "muscular" begin?

*M-u-s-c...*

Ok. Now "muscle."

*M-u-s-c-l-e...*

It was a struggle, but she got there. The next try showed how little understanding she had of the idea that words are actually connected to each other in meaning and form, even words that she was perfectly familiar with.

How do you spell "sign"?

*S-i-g-h-n*

What do you call it when you sign your name?

*Your signature.*

How do you spell "signature"?

*S-i-g-n...*

Ok. So how do you spell "sign"?

*S-i-g-h-n*

But you just told me that "signature" begins with S-I-G-N . . . !

*So what's one got to do with the other?*

This is the sort of thing that needs attention if a child is to improve his spelling. Better spelling is not a matter of individual words (S-i-g-h-n on the analogy of *sigh* is actually a pretty good try as an isolated word.), but will come about as an outgrowth of an understanding and awareness of the relationships between words.

Still another type of exercise involves consonant alternations which occur not

only in the pronunciation  
For example, the letter

It helps to recognize  
spell the pronounced  
cause it is related to  
alternation is general

It is interesting to  
really a [t]-[s] alternati  
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of *pirate* automaticall  
[payrətiy], the phonol  
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Exercises such as the  
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only in the pronunciation of words, but are reflected in the orthography as well. For example, the letter *t* and *c* alternate in many word pairs:

| (1)          | (2)         |
|--------------|-------------|
| coincidental | coincidence |
| pirate       | piracy      |
| president    | presidency  |
| present      | presence    |
| resident     | residence   |
| lunatic      | lunacy      |
| democratic   | democracy   |

It helps to recognize the general pattern, for it resolves the question of how to spell the pronounced [s] of column (2). *Presidency* is spelled with *c* and not *s* because it is related to *president*, *presence* is related to *present*, and so on. The *t-c* alternation is general enough so that being aware of it can be useful.

It is interesting to note that this *t-c* orthographic alternation, which is phonetically a [t]-[s] alternation, is a phonologically predictable alternation. It requires only one underlying lexical spelling, with *t*. I.e., the *t* of the underlying form of *pirate* automatically becomes phonetic [s] in the context -y, so that instead of [payrətiy], the phonological rules produce [payrəsiy]. By the same rules *president* + y becomes [prɛ zə dən siy], and so on. The orthography chooses to reflect this phonetic change in the case of [t] → [s] whereas it ignores many other such automatic phonetic changes, as we have seen. For example, it does not reflect the phonetic change [k] → [s] as in *medical-medicine*. When the orthography reflects a phonetic change such as [t] → [s] in *pirate-piracy* it corresponds to an internal level of representation which is not as abstract as the lexical level. Some phonological processing has already been applied to the lexical spelling to produce the phonetic variants indicated by the orthography.

Exercises such as these are to be construed as samples of a particular approach which can be extended as the need arises. However, it is perhaps much more to the point for the teacher to develop a way of dealing with spelling errors that the children produce day by day than to equip herself with preselected word lists. Most important is that she transmit to the child the notion that spelling very often is not arbitrary, but rather corresponds to something real that he already knows and can exploit. A good way to handle misspellings that come up in class is to search with the child for a systematic reason why the word should be spelled

the way it is, if indeed one can be found. In many cases, such a reason can be found. Often this will mean simply bringing a relation between two familiar words to the child's attention. To use some examples drawn from the spontaneous writing of a group of 3rd and 4th graders, the child who misspells *president* as *presedent* needs to have pointed out that it is related to *preside*. The child who misspells *really* as *relly* needs to think of *reality* to get it right. *Apon* is more likely to be written *upon* if the child realizes that it is a combination of *up* and *on*. *Immagrate* will become *immigrate* if it is connected with *migrate*. *Medisin* will lose the *s* and acquire a *c* if it is connected to *medical*.

Sometimes a related word that could help settle the difficulty for the child is a word that he doesn't know. *Illustrative*, for example, may not be part of the vocabulary of the child who writes *illastrate* for *illustrate*. In such cases, it may make better sense to introduce the new word than to have him memorize a seemingly arbitrary spelling for his familiar word.

Exploiting opportunities that come up naturally in class is certainly one of the most dynamic ways of fitting words into context and developing the idea of word relationships. This can be exciting and can really increase children's language sense if undertaken by a teacher who enjoys etymologies and who is sensitive to language herself. Herbert Kohl's excellent description of just such a beginning and where it can lead in *36 Children*<sup>5</sup> is one of the best examples I have seen recently of how meaningfully this can be done. Starting with one child's use of the word "psyches" as an insult (The children visualized this word as s-i-k-e-s.), he led the class into a discussion of etymologies, Greek myth, word meanings, and word relationships. It caught on. Over a period of time the undertaking was extended to include word origins more generally, the question of how words acquire their meanings, and even a consideration of historical change and the notion of "right" and "wrong" in language in a descriptive vs. prescriptive framework.

The general conclusion to be derived from the view of the orthography presented here is that spelling, far more often than it seems from a purely phonetic standpoint, does make sense. Many spelling errors could be avoided if the writer developed the habit of looking for regularities that underlie related words when in doubt. This is part of the strategy used by good spellers as a matter of course. For the child who spells poorly it is far more productive to learn how to look for these regularities than simply to memorize the spellings of words as iso-

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<sup>6</sup> From a letter published  
by Mackay and Thompson  
guistics and English Teac  
and Co., Ltd., London and

<sup>5</sup> Herbert Kohl, *36 Children* (New York: The New American Library, 1967), pp. 23-29.

lated examples. Providing him with a strategy based on the realities of the language is clearly the best way to equip him to deal with new examples on his own.

It would be less than realistic to close this discussion of the regularities of English spelling without a glance at the other side of the coin. English spelling does after all have its less consistent aspects. To restore a sense of balance I offer the following passage in conclusion.

*Hints on Pronunciation for Foreigners<sup>6</sup>*

I take it you already know  
Of tough and bough and cough and dough?  
Others may stumble but not you,  
On hiccough, thorough, laugh and through.  
Well done! And now you wish, perhaps,  
To learn of less familiar traps?

Beware of heard, a dreadful word  
That looks like beard and sounds like bird,  
And dead: it's said like bed, not bead—  
For goodness' sake don't call it "deed"!  
Watch out for meat and great and threat  
(They rhyme with suite and straight and debt.)

A moth is not a moth in mother  
Nor both in bother, broth in brother,  
And here is not a match for there  
Nor dear and fear for bear and pear,  
And then there's dose and rose and lose—  
Just look them up—and goose and choose,  
And cork and work and card and ward,  
And font and front and word and sword,  
And do and go and thwart and cart—  
Come, come, I've hardly made a start!  
A dreadful language? Man alive.  
I'd mastered it when I was five.

T. S. W.

(only initials of writer known)

<sup>6</sup> From a letter published in the *London Sunday Times* (January 3, 1965), from J. Bland. Cited by Mackay and Thompson, "The Initial Teaching of Reading and Writing," *Programme in Linguistics and English Teaching*, Paper no. 3, University College, London, and Longmans Green and Co., Ltd., London and Harlow, 1968, p. 45.