A LANGUAGE-ORIENTED VIEW OF READING AND ITS DISABILITIES*

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For the past 15 years or so, my main research interest has been in early reading acquisition and the problems associated with it. During all that time, my colleagues and I in the Haskins Laboratories reading research group have been stressing the importance of language and the alphabet in the reading process, and, consequently, in its disabilities.

For most of that period, however, we (and a remarkably small number of other investigators) were rather lonely warriors battling against a massed field of special educators with quite different ideas about reading disabilities. Most numerous in the early years were the practitioners in schools, hospitals, and optometrists' offices, who approached the reading problem armed with balance beams, trampolines, parquetry blocks, strings of wooden beads, swinging balls suspended from the ceiling, and the like. The activities using this equipment were expected to improve the children's gross and fine motor coordination, which in turn were considered to be the foundation of visual perception, and then eventually were meant to correct deficits in visual perception itself, which were purported to be the root cause of reading problems.

Common sense had little place in all this. Simply ignored was such contrary evidence as the fact that spectacularly coordinated animals, including the great apes and some humans in professional athletics, had excellent visual perception but could not read, while their poorly coordinated, indeed, even crippled, brothers and sisters, whether seeing or nearly blind, might be fluent readers. Moreover, little research was directed toward actually exploring the verity of the hypothesis or the efficacy of the remediation based solely upon it (luckily for the children under their charge, many practitioners of this persuasion hedged their bets by adding daily reading remediation to their gymnastic and visual perceptual routines). When such

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questions were at long last examined with care (Hammill, 1972), the evidence was found to be, indeed, strongly opposed to the view that poor motor coordination and visual perception were the root causes of most reading problems or that most reading problems could be eliminated by means of gymnastic and visual exercises. One could dare hope, then, that such procedures would finally be seen as useful for the remediation of other problems present in some poor readers, problems like clumsiness or poor visuo-motor coordination, but not for reading remediation, and that such procedures would perhaps produce better ball players and bicyclists, but not necessarily better readers.

Recently, the situation did appear to be improving. There was more emphasis on language development and language processing in the special education journals. The teachers in the field were beginning to question the old routines; the teacher-trainers and the new special education texts seemed to be increasingly language-oriented. Publishers began putting "linguistic" in the titles of their reading series for the elementary grades and in the brochures used to promote their offerings—"linguistic" had clearly become a buzz word for "a good thing."

Unfortunately, it appears that the battle was far from won: just because something was called linguistic did not at all insure that it was indeed a good thing. A case in point is an approach to reading instruction that has taken regular education by storm and seems about to sweep special education as well. Its proponents (Goodman, 1976; Goodman & Goodman, 1979), who call reading "a psycholinguistic guessing game," suggest that because the main goal of reading is to derive meaning from print, we should teach children to go somehow directly from print to meaning, as skilled readers supposedly do. According to their position, the teacher should not correct a child who misreads dog as "cat." It is not such a bad error, they say—after all, since dogs and cats are both animals, the child has hit upon the correct category of meaning, and according to this instructional approach, it is general meaning, not the apprehension of any particular word, that should be rewarded. Moreover, they argue, attention to the phonology represented by the alphabetic characters would slow the reader down and make it harder for him to attend to meaning. In fact, a useful technique for teaching beginning readers, we are told by one practitioner of this approach (who apparently does not shrink from carrying it out in its most extreme form), would be to splash ink on the passage to be read and then to let the child practice reading by guessing what might have been hidden under the ink spots (Giordano, 1980).

The underlying assumptions of the psycholinguistic guessing game approach seem to be: first, that skilled readers do ignore the word and make little use of the phonology that is represented by the letters of the word, depending instead largely on guessing from the shape of the letters and the context to get at meanings; second, that readers can go faster that way; and third, that skilled readers have the kind of attentional control that permits them to determine by choice when to look at letters as representing the phonology and when to look at them only as visual shapes. All of these assumptions are questionable in our view, and, in any event, remain to be demonstrated. But perhaps the most misguided assumption of all, from my point of view, is that any reader should ever go directly from print to meaning.
ORTHOGRAPHIES: REPRESENTING UNITS OF LANGUAGE

I take it as given that in understanding language, whether written or spoken, one does not normally go directly to meaning. Rather, the listener or reader gets to the meaning via the language—that is to say, by dealing in distinctively linguistic ways with the units of the language (for example, phonological segments, words) and also the larger syntactic structures (sentences) they form. Surely, some kind of linguistic processing, however automatic, is necessary, for in language, as in everything else, there is no free lunch. Moreover, the processes that extract meaning from language are different in important ways from those that extract meaning from a picture. Perhaps one can go quite directly from a picture to one or another of its typically many meanings. I don't really know, and I suspect that no one else does either. But, whatever the processes by which we get meaning from a picture, the processes by which one gets it from language are different. Words and sentences are uniquely linguistic things, after all. A word is represented in a person's vocabulary as a string of abstract, meaningless phonological units, and its relation to meaning is arbitrary; there is absolutely nothing about a word that can possibly give its meaning "directly." As for a sentence, its meaning is even less directly available; surely, it is not to be had by summing the meanings of the constituent words. In some important sense, the meaning of a sentence is in its structure, and unearthing that meaning must depend on the use of uniquely grammatical devices—word inflections, word order, grammatical words (e.g., of, a); accordingly, the listener and the reader are both well advised to take account (we hope automatically and painlessly) of the appropriate grammatical structures and devices.

As ways of communicating messages, there is, then, an important difference between pictures and language (whether spoken or printed). Perhaps, as I suggested, there are pictures that do enable a viewer to "go directly to meaning." If that is an advantage, so be it. Indeed, I would add it then to another advantage that pictures have over language: they are often aesthetically more pleasing. But for the purpose of precisely conveying ideas, pictures are clearly inferior. How would you say, "The science of physics is far advanced," in pictures? But notice how easy it is to do that with language. Indeed, we can even do it with print, but only if the reader understands that the print represents the language.

All of the foregoing seems obvious enough, yet we are told by some that, because the main goal of reading is to derive meaning from print, which hardly needs saying, we should teach children to do that directly, which is a different matter altogether and badly wants contradicting. For if encouraging the child to go "directly to meaning" means anything at all, then it must be that we are being urged to teach the child that the print represents meanings, when, in fact, it represents the words of the language. And that does appear to be what we are being urged to do, when we are told—to take the example I used earlier—that the child who reads "cat" for dog is really on the right track. The basis for that misguided conclusion is that dog and cat are clearly related in some semantic way, so the fact that the child reads one when the other was written merely shows that his quick mind leaped immediately to the meaning and only missed it by a small amount. I would suggest, on the contrary, that this poor child has not the dimmest notion of what reading is
about. The most likely explanation of his error is that he treated the word as if it were a picture, but being unable, of course, to determine precisely what it was a picture of, he looked at its general shape, remembered only that he had learned to associate that with some animal, and so, on being presented with dog, recalled another member of the set of animals he had seen represented. Such a child will never become an accomplished reader until he discovers—one hopes that a teacher might help him to discover—that the characters d o g are a phonological representation of a word. That word may have any or all of a variety of meanings to the reader. "That animal is a dog." "Why do you dog my footsteps?" "That movie is a real dog." But what stands fixed and firm is that the word is "dog" and that the print precisely represents it. (Imagine, by the way, how it might be that in reading a sentence, one would see a grammatical word like of. Would he go directly to its meaning? What is its meaning in isolation? Or, as I think plausible, would he read the word of and then hold it in some buffer until enough of the other words have accumulated to make it possible for him to apprehend the linguistic structure of which the word of is a part?)

But suppose all do agree that in reading a word the trick is to recover the word and then let the meanings follow as they normally do. There remains the question: how does (or should) the reader find the word? And here, too, we are often given advice that seems wrong-headed. I have in mind the frequently-made assertion that children should be taught to read words as wholes because that is what skilled readers are assumed to do. But, as I see it, the assumption that words should be read as wholes is either trivial or wrong, depending on just exactly what is meant. If reading a word as a whole means merely that one takes in a half dozen or so letters at a single fixation, then we are simply dealing with a well-known fact about optics, anatomy, and physiology, and not a prescription about how to read. Surely, all readers take in many letters (and most words) at a glance. But if, on the other hand, reading a word as a whole is meant to be a statement about how one reads, then it can only mean that the reader should not (does not) apprehend the internal phonological (or morphophonological) structure as represented by the letters, but rather should (or does) respond to some (always undefined) holistic characteristic. If that is what happens, however, then what kind of fix is the reader in when the word is itself not a whole—when, in fact, it has component parts? Take the words goodness and badness. If reading those words as wholes means anything at all, then it must mean that the reader does not apprehend the sublexical element—namely, "ness"—which is common to the two words, and that he therefore cannot appreciate that good is to goodness as bad is to badness. Or take walk, walks, and walked. To read those as holistically different from each other is to miss the critically important relations among them. It would seem, then, that to encourage a beginning reader not to take advantage of the phonological and morphophonological information in a printed word is to encourage him to miss a great deal of what is going on in the language and, inevitably, to become a poor reader.

Thus, my conception of the reading process begins with the seemingly obvious assumption that an orthography represents a language. It follows, then, that if we would understand what reading requires of a child, and especially why those requirements should so often be hard to meet, we must see exactly how the orthography represents the language, and why, given that kind of representation, it might be hard for the child to make the connection.
That is what has guided the research of my colleagues and me, and led us to pay particular attention to two critical aspects of the reading process. The first has to do with the reading (and understanding) of words: given a printed word, how does the reader (indeed, how should the reader) find in his lexicon the real word that the printed word represents? The second part has to do with the reading and understanding of sentences: given that the reader has got the words, how does he hold them until he can extract the meaning from the structures they form? In this paper, I will deal almost exclusively with the first: how one reads the words. I will be especially concerned to say why that might be difficult, and I will offer suggestions about how the teacher might make the task somewhat easier. I mean to take seriously the assertion that a writing system represents the language, for it is only when we understand this that we can see why certain kinds of difficulties might arise. So I will begin by describing various orthographies, including especially the one we use in English, with emphasis on the cognitive problems they present, especially to the beginning reader. Then, I will present evidence that these difficulties do, in fact, arise, and suggest how they have been misinterpreted. And, throughout, I will offer a few ideas about instruction that teachers will, I hope, find useful.

Picture writing, the earliest attempt to convey information for the eye, represented objects, events, and general meanings, rather than segments of language. By its very nature, however, it was open to different interpretations by different observers. A picture of archers meant by the artist to represent the hunt might, instead, have been interpreted by an observer as "archery," or "manliness," or "blood sport," or, indeed, as whatever other meaning the given observer might have associated with that picture. If we had not progressed beyond a pictographic system, therefore, we could communicate only vague, ill-defined areas of meaning.

Proper writing and reading may be said to have begun whenever it occurred to someone to convey a message, not by drawing a picture of some object or event, but by using optical patterns to represent the language. Though, as we will see, there are several ways to do that, the choices are really quite severely constrained. The first, and surely the most important, constraint has to do with a universal characteristic of language—to wit, that it is always made up of discrete units or segments (phones, phonemes, syllables, morphemes, words, phrases, sentences). The constraint on an orthography is that it must represent one or another set of those segments. (Imagine trying to read an orthography whose individual characters each represented a word and a half.) But there is a certain amount of choice as to just which segments will be represented. The most general aspect of this choice derives from a second universal characteristic of language: there are always two kinds of segments, meaningful (sentences, words, morphemes) and meaningless (phones, phonemes, syllables). Accordingly, some orthographies use their characters to represent meaningful segments, others one or another of the meaningless segments.

Let us, then, take a quick look at the several kinds of orthographies, trying in particular to see what various difficulties they might or might not present to the beginning reader. Among the meaningful units, we will here consider only the shortest unit, the morpheme, the unit most commonly represented. As for the meaningless units, we will consider the syllables,
and also the constituent sounds, phones, and phonemes of which they are composed. The phonemes are, of course, the segments that are represented in the alphabetic orthography we use, but because there is so much confusion about what a phoneme is, and how it differs (or, indeed, whether it differs) from phonetic units and from the sounds of the language, I have included phonetic units and sounds as possible bases for an orthography.

The guiding principle of our search among the orthographies can be put very simply. Reading and writing are, by comparison with listening and speaking, relatively unnatural and derived. All speaker-hearers of a language are provided with a neuropsychology that normally functions naturally and automatically—that is, below the level of awareness, to cope with the structure of language (A. Liberman, Cooper, Shankweiler, & Studdert-Kennedy, 1967). In contrast, the reader and writer must be something of a linguist—able, at the very least, quite deliberately to divide utterances into the constituent segments that are represented by the characters of the orthography. As we will see, the ease or difficulty with which that can be accomplished will depend, in large part, on the nature of the linguistic unit that the orthography represents.

ORTHOGRAPHIC REPRESENTATION OF WORDS

Among orthographies—true writing systems, that is, as distinguished from communication by means of pictures—are those that represent such meaningful units as morphemes or words. Certainly, the best known examples are Chinese and its adaptation in the Kanji part of Japanese. The exact ways in which the characters of these orthographies convey the Chinese and Japanese languages is complex (see, for example, Martin, 1972). For our purposes, however, it is sufficient, and sufficiently accurate, to say that the individual characters of the orthography, often referred to as logograms, represent morphemes (the shortest units of the language that have meaning) or words. Indeed, it does no real harm to the point I wish to make here to say that a character refers to a word. Of course, each logogram is decomposable into visually distinguishable parts (strokes), and these may be important in the recognition of the character, but they have no linguistic significance—they do not, for example, represent the sublexical phonological components of the word as the letters of our alphabet do. Logograms are used in English too—for example, the dollar sign or the arabic number 5—but they are the exception in our writing system.

From our point of view, the most important characteristic of a logographic writing system is that it presumably imposes a light cognitive burden on the beginning reader. To see why this is so, we again take account of the fact that any reader or writer must, at the least, be able to abstract from the utterances of a language exactly those units that the orthographic characters represent. (Like so many things that are important and seemingly obvious, this requirement is often unnoticed.) But if, as in the case of logographies, the unit is the word, then surely the cognitive task is relatively easy. Words are isolable units, after all, which is to say that they can be, and often are, produced outside the larger contexts (sentences) in which they typically occur. Nevertheless, studies have shown that very young children (Downing, 1971, 1972) are more than a little uncertain when
asked (in effect) to abstract words from spoken sentences. But the difficulty is quite easily overcome (Engelmann, 1969). There remains, then, only the task of learning to associate a written character with the word it represents. That is simply paired-associate learning, and, up to a point, children are good at it.

There are, then, reasons for supposing that a logographic system should be quite easy for the beginning reader. Accordingly, we are not surprised to find evidence that perhaps it is. In a later section, I will outline that evidence. For the moment, let us simply ask: if a logographic orthography is relatively easy for children to master, why not teach them to read English as if each spelled word were a logogram? Why not, indeed, since we are often advised by educators (advocates of the "whole-word method," see Rosner, Abrams, Daniels, & Schiffman, 1981) to do precisely that (though not usually for the reasons given above). There are at least two reasons why not, and, precisely because we are so often urged to pretend that English should be read as if it were Chinese, I should take a moment to say what those reasons are.

The first reason why children should not be taught (or even permitted) to suppose that a spelled English word is a logogram is in the nature of the logographic system, and it is obvious: logographies are not as productive as the alphabet. That is, there is no way for a reader to read a morpheme whose associated logogram he had not previously seen and committed to memory. As a consequence, the reader of a logography must memorize thousands of characters, an assignment that will occupy him for many years. Even the Chinese have had to find ways out of this difficulty. Thus, for many of their characters—for most of them, if frequency of occurrence is taken into account—there are phonetic elements that lighten the memory load somewhat by providing indirect clues to pronunciation. In any case, a child who learns to read English words as if they were logograms will never be able to read a word he has never seen in print before. That much is surely obvious. Only slightly less obvious is the fact that, unlike the characters of the Chinese orthography, the letter strings formed by an alphabet are ill suited to be apprehended by overall shape or, indeed, by any means that does not take account of the distinct and distinctive letters. If we should be so misguided as to want children to read English words without appreciating their internal structure, we should, at the least, design an orthography that is more appropriate to that aim (Brooks, 1977).

The second reason has to do with differences between Chinese and Japanese, on the one hand, and English, on the other, differences that tend in the former cases, but not in the latter, to balance the inherent disadvantages of a logographic system with certain special advantages. Consider, in this connection, that there is in both Chinese and Japanese a great deal of homophony—many instances, that is, in which words that are phonologically the same are semantically different. Logograms nicely disambiguate these words and thus serve an important purpose. English does not have this characteristic to any considerable extent. We should also consider in this connection that Chinese has no inflections—for example, case or tense—so the user of a logographic system has only to associate logogram with word. There is no need to have a holistically different logogram for every inflected form of the word, nor is there, alternatively, any need to tax the reader-writer's linguistic ability by requiring him to mark the grammatical status of the word.
with some abstractly grammatical character that means, for example, "indirect object of the sentence." It is surely not trivial that in the Japanese adaptation of the Chinese orthography all grammatical inflections (and Japanese, unlike Chinese, does have these) are rendered phonologically in the Japanese syllabary (kana). English, of course, does have grammatical inflections which must be taken into account. Finally, there is in Chinese the special advantage that a logographic system can more easily be read across the several Chinese languages that are related but not mutually intelligible. We have no need for such an arrangement in English.

There are, then, two points to be made here. The first is that, yes, it is possible to represent a language orthographically with characters that refer not to the phonological constituents of words, but to the words themselves. But meanings are conveyed, in the orthography as in speech, by the words (including especially the grammatical words—of, to, or, etc.) and the larger grammatical structures they form. The second point is that, whatever special advantages a logography may have in Chinese or Japanese, it is ill suited to English. We have reason to be thankful that our English orthography is not logographic, and we should hesitate to design our reading instruction as if it were.

ORTHOGRAPHIC REPRESENTATION OF PHONOLOGIC UNITS

As we have seen, a logographic system is not, as it were, productive: readers cannot cope with a character-word correspondence they happen not to have seen before, but must rather learn a new character for every morpheme read. This is surely a great disadvantage, given that the number of morphemes in a language—hence the number of characters—runs into thousands. But when the characters of the orthography represent the meaningless units of the orthography that disadvantage is overcome: the phonological units are far less numerous than the words, and, once mastered, the system makes it possible for readers to cope with words they have not seen before, including even those newly invented words the language may have chosen to incorporate. Let us turn, then, to such orthographies, dividing them into two classes, according to the size of the phonological unit (the longer syllable or the shorter phone or phoneme) they represent.

Syllables and Syllabaries

Perhaps the best known example of a syllabary is the Japanese kana system. The linguistic unit is, strictly speaking, the mora, which is defined in temporal as well as ordinary syllabic terms, but we do not seriously misrepresent the matter if we regard it as a syllable and the orthography as a syllabary. In fact, there are two syllabaries for Japanese, the katakana, which is used for writing many imported foreign words, and the hiragana, for conveying grammatical inflections. There are 49 kana characters in each, corresponding to the same 49 syllables of the language.

What, then, is the cognitive burden that a syllabary imposes on a child? How difficult is it for him to abstract from his speech and from that of others the units that a syllabary represents? The answer to this question is to be found in part in the results of several studies (Calfee, Chapman, &
Venezky, 1972; Fox & Routh, 1976; Gleitman & Rozin, 1973; Liberman, 1971, 1973; Liberman, Shankweiler, Fischer, & Carter, 1974). These indicate that the young child comes more easily and more quickly to an explicit awareness of syllables than of the shorter phonological segments that an alphabet represents. The reasons for this are easy to see, once we understand how the processes of articulation and coarticulation merge the constituent phonetic segments into units of approximately syllabic length (A. Liberman et al., 1967). This is to say simply that, like words, syllables can be rather easily separated in the speech stream and pointed to, as it were, but most consonant constituents of a syllable cannot be made to stand alone (without an accompanying schwa). At all events, to the extent that a child must abstract from speech those units his orthography conveys, syllables present fewer difficulties than phones or phonemes.

But the research on how readily children become aware of syllable units only takes account of their ability to determine how many syllables there are in an utterance. It does not deal with their ability to find the exact boundaries. For a language like Japanese, in which syllables have a relatively fixed consonant-vowel structure ("Fuji," "Watanabe," "Mikimoto"), finding the boundaries poses no great problem. But where there is a great variety of syllable structures, as in English, the matter is considerably more difficult. Thus, even though we can easily perceive that a word like "federal" has three syllables, it is not that clear where the boundaries ought to be. We should also expect that a syllabary would be more troublesome as the number of different syllables increases, and then note in this connection that, in contrast to the small number of syllables in Japanese, there are thousands in English. The point, then, is that a syllabary might well have advantages for the reader, especially the child, but only in languages that have certain properties. English does not have those properties, and, in any case, it is not written with a syllabary.

Sounds, Phones, and Phonemes: Alphabets

We come now at last to the alphabetic orthography, the vehicle for the written form of English and, indeed, of most of the languages our students are likely to learn. The system has many advantages, especially for languages like English, but it also presents certain problems, both for the child who would learn to use it and for the teacher who would help him to do that. In reading an alphabet, as in reading a logography or a syllabary, the reader must be able quite explicitly to appreciate the relation between the orthographic character and the linguistic unit it represents. I have already made the point that this need not be very difficult for a logography or a syllabary. However, it can be quite difficult in the case of an alphabetic orthography (Liberman, 1971; Liberman et al., 1974). and it is so for reasons that we understand quite well. The essence of the problem can be put this way: though it is often said that an alphabetic orthography represents speech (or supposedly ought to in the ideal case), in fact, it is, and forever must be, an abstraction from speech. It does bear a regular relation to speech, barring a few egregious exceptions, but the nature of that relation is hard for the child to apprehend. To understand why, let us see in exactly what ways it is misleading to say that an alphabetic orthography represents the sounds of speech.

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Sounds. Alphabetic orthographies do not represent the sounds of speech. There are two senses in which this is so. One is obvious and quite trivial: the optical shapes of the letters do not portray the acoustic events, though they might well do just that if they were snippets of oscillograms or spectrograms. The other is not so well understood but far more important: the segmentation of the sound does not correspond directly to the segmentation indicated by the letters. Because of the way speech is normally articulated and coarticulated, information about several of the phonological and phonetic segments—the segments that are represented approximately by the letters of the alphabet—is transmitted simultaneously and on the same part of the sound. The consequence is that in a word like "big," for example, there is no acoustic segment corresponding to each letter segment. That is, it would be impossible to divide a recording of the spoken word "big" into three parts so that, when played back, one part would be "b," one part "i," and one part "g." In the syllable "big," there is but one piece of sound, and the three phonological segments that we write as b, i, and g have been more or less simultaneously encoded into it. This distinctively linguistic way of encoding the phonological segments into the sound is essential to the efficient perception of speech, for if each phonological segment were represented by a segment of sound, then communicating phonological structures at rates that range from 8 to 30 segments per second, as is normally done, would far overreach the temporal resolving power of the ear. As a result, the separate segments of the phonological message would merge in perception into an unanalyzable buzz. So, encoding several segments of the phonology into one segment of sound provides for an important gain in efficiency when one is listening to speech. But this gain exacts a price, for there is now a peculiar relationship between the phonological message and the acoustic signal that conveys it. Fortunately for the listener, however, he has access to a biologically specialized system that enables him effortlessly and automatically (though tacitly) to cope with the code and recover the message it conveys (for a fuller treatment of these matters, see A. Liberman, 1982; A. Liberman & Studdert-Kennedy, 1978; A. Liberman et al., 1967).

But the curious code that connects phonological structure to sound has two adverse consequences for the would-be reader. One is that it makes inordinately difficult the task of "reading" a spectrogram or, indeed, any other representation of the actual sounds of speech. Thus, it is not only true that alphabets do not, in fact, represents the sounds of speech, but, more important, it is just as well that they do not, for if they did, reading would be a slow and onerous business for us all.

The other consequence for the reader is that, for many of the segments of the language, there is no simple and direct way to demonstrate to him the relation between spelling and sound. If the teacher nevertheless undertakes to do this with a word like "big," she will be driven to isolate three sounds and in the process, she will unavoidably produce three syllables: "buh," "ih," and "guh." But they form a nonsense trisyllable, not the meaningful monosyllable that comprises the three phonological segments we spell as big.

None of this is to say that the phonological segments represented by the alphabet are fictions. Not at all. They are real enough and, as already indicated, are recovered at least tacitly by the listener as he processes the sounds of speech. But that processing is carried out by physiological
mechanisms that appear tied to an acoustic input. If we would put speech into visible form and make it readable, we must, at the least, spell out the segmented form of the message by using the normal linguistic capacities of a human being to recover that form.

Phones. But suppose now that by paying careful attention to what we perceive when we listen to speech, we use the human being's linguistic ability to abstract from the acoustic signal the string of phonetic segments that it conveys, the phones. Now we are just one step removed from the sounds of speech. We have achieved a proper segmentation, and we can represent each perceived segment by an alphabetic character. Indeed, that is done in the phonetic alphabets that linguists use to transcribe as accurately as possible what they perceive when they listen to speech. But now we encounter another difficulty. It is that the wealth of phonetic information that the natural speech-perceiving mechanisms know how to use creates serious problems when, as in reading and writing, we short-circuit those natural mechanisms and put the information through the eye.

A phonetic transcription, that is, a transcription representing the phones of speech, preserves much surface information that is not represented in an alphabetic orthography. For example, a phonetically written orthography would reflect all the context-conditioned variations of speech both within words and across syllable and word boundaries. Thus, within words, the plural "s" after an unvoiced consonant, as in "cats," would be transcribed as s, but its counterpart after a voiced consonant, as in "dogs," would be transcribed as z, to reflect its pronunciation in that context. The stressed and unstressed forms of vowels would also be assigned different symbols instead of remaining the same as they do in telegraph-telegraphy. Similarly, the different pronunciations of the same consonant in different positions in a word, like the "t" in "tap" and in "pat," would demand different symbols because the careful listener could differentiate between them in the contexts of those two words.

The possibility that the recognition of such minute articulatory distinctions might actually detract from the broader requirements of efficient language representation becomes even more compelling when we see how context-conditioned variations of pronunciation across syllable and word boundaries would affect the phonetic transcription. For example, the final consonant in the word "bat" would be transcribed as t, but what we ordinarily consider to be the same consonant in the related word "batter" would have to be changed from t to d, in order to accurately reflect the manner change in our pronunciation of that segment from voiceless to voiced in the disyllabic context. Similarly, the contraction "what's" would be transcribed quite differently in the context of the sentence "What's he doing?" from its transcription in the context of "What's your choice?" where because of context-conditioned effects, it would be coarticulated with "your" to produce "Wuhchor choice?" in everyday spoken English and would therefore have to be transcribed that way in a phonetic rendition.

This brings us to another problem posed by a truly phonetic transcription, the question of what indeed is "everyday spoken English"? Idiolects, which would ordinarily be represented in a narrow phonetic transcription (e.g., a speaker's lisp, or difficulties with "l" and "r"), could perhaps be
disregarded, but what about dialectical differences? Indeed, how would the received pronunciation be determined for purposes of devising an orthography? And would there need to be a different orthography, therefore, for English and American speakers of English?

It must now be apparent that it would be extremely difficult to apprehend a message that was conveyed by means of a narrow phonetic transcription. Though it has its uses for the phonetician whose very task it is to study these fine points of difference in speech, a phonetic transcription would usually give us as readers not only more information than we need, but actually, for our particular purposes, might often get in the way, by providing many data that we cannot efficiently use while hiding or obscuring other data that might have been helpful.

As it happens, although any literate adult can decode a transcription based on phones considerably more easily than he can decode a visual display of acoustic events, even highly trained phoneticians cannot read an unfamiliar text written phonetically with the same degree of fluency that they would show in reading the same passage written in our much malign English orthography.

Thus far, in this necessarily brief discussion of options available for transcribing a language, we have touched upon the shortcomings, either in relation to cognitive load or to mismatch with our language, of a system using a meaningful unit, the morphemic unit of language, and also of several others, in which meaningless units, including syllables, sounds and phones, were the candidates for transcription. With these considerations in mind, we can now explore in somewhat greater detail the phoneme or morphophoneme, the meaningless segment that is used to represent the language in our alphabetic system.

Phonemes and Morphophonemes. Given that reading the sounds of speech is inordinately difficult and reading a proper phonetic transcription only slightly less so, what is it that an alphabet should represent if reading is to be as easy and fluent as possible? The relevant considerations are, I think, roughly as follows. We ask, first, how the words of the language are represented in your head and mine—in the lexicon every speaker has in his head. Certainly, they are not there as auditory templates, for, if they were, the speaker—listener would need a different lexicon for every different auditory shape that a word has as a consequence of variations in context, rate, linguistic stress, emphasis, idiolect, dialect, and goodness knows what else. Almost as certainly, words in our lexicons are not represented in narrow phonetic form, for in that case, too, we should have many lexicons, corresponding, again, to the numerous systematic variations that occur in response to many of the same factors that cause gross changes in auditory shape. Accordingly, it is altogether reasonable to suppose that some kind of systematic phonology, similar to what linguists like to talk about, does in fact exist as part of the normal person's language faculty. That is to say that your lexicon and mine are presumably organized in terms of phonological segments sufficiently abstract to stand above the many variations at the auditory and phonetic surfaces. Thus, you and I recognize that the word "telegraph" is the same word no matter what the idiolect or dialect (of English), and no matter what phonetic changes might have occurred because of a particular word that preceded or followed it in the sentence. Indeed, it is reasonable to suppose, at least in this case, that we tacitly command the rule
that relates the phonetic structure of "telegraph" to the rather different phonetic structures of "telegraphy," and "telegraphic," and that the similar spellings are, accordingly, perfectly transparent.

When a person gets language by ear, then, the auditory and phonetic variations are processed automatically, yielding, finally, the more abstract form in which the word is contained in the listener's lexicon. Indeed, there is reason to believe that the more 'surfacy' variations in the auditory and phonetic domains actually provide important information, helping the system to isolate the words from the sentence contexts in which they appear and to identify them properly. But when we try to put language in by eye, then, as we have seen, difficulties arise if we begin with the (systematically) variable auditory and phonetic forms. To circumvent these difficulties, I should think we would want the words to be spelled in a way that precisely matches the quite abstract phonological structures in terms of which they are spelled in the reader's lexicon.

But there's the rub. For though we can be reasonably sure that the words in our lexicons are spelled quite abstractly, we don't really know exactly how abstractly. I suppose that, for most speakers of English, the phonetic "s" of "cats" and the phonetic "z" of "dogs" are represented the same in their lexicons, reflecting the underlying (morpho)phonological sameness of the plural, and I suppose the same is true for the phonetic changes that occur as a function of linguistic stress, as in the variations that are rung on a word like "telegraph." If those suppositions are correct, then it is, indeed, wise and proper that these words are spelled in the abstract form that immediately reveals to the reader what it is that they have in common. But what of the phonological alternations that make it sensible to keep the vowels the same in such pairs as heal–health, weal–wealth, and steal–stealth? One suspects that while some speakers of English comprehend those relationships, many others do not. Which brings us then to another difficulty we should have if we were trying to devise the ideal orthography: there are presumably great differences among speakers of the language in the way their lexicons are organized. To the extent that is so, the perfect orthography becomes impossible.

Given that every alphabetic orthography spells words quite abstractly, and given that this is as it should be, there remains a rather wide margin of choice as to how abstract the system should be and precisely which abstractions it assumes the readers command (see Klima, 1972, and Venezky, 1970, for a more detailed discussion). For better or worse, English spelling is rather far out on the abstractness dimension, from which it follows that it must strain the linguistic sophistication of many who would read (and spell) it. The young child is especially likely to lack even the tacit knowledge that would rationalize so much of the spelling, and, as I mean to say in the next section, that creates a difficulty. But it is a difficulty that is not too hard to overcome, especially if the teacher truly understands its nature.

But perhaps the point to emphasize here is that no matter how abstract it may often be and how far or how close to a given reader's lexicon, the alphabetic orthography does, nonetheless, represent the internal phonological structure of the spoken word. Moreover, it does so by means of a remarkably economical set of only 26 symbols, which provide entry into the entire printed vocabulary of the language. To readers who understand and utilize the
relationship between these symbols and the language, this orthography affords a unique advantage, certainly not available to the readers of a logography. Their advantage is that they can read words they have never seen before. They do not have to memorize the association between each symbol pattern and the word it represents before they can read it, as the logographic reader must.

LINGUISTIC SOPHISTICATION AND READING

In the light of the preceding discussion, we can turn again to the question of what children must know in order to learn to read. Beyond the obvious need to have some command of the language and the ability to discriminate the graphic symbols, the first requirement for beginning readers, in our view, is to acquire a certain amount of linguistic sophistication. The difficulty of acquiring the sophistication needed will, as I have said, vary with the language and the orthography. Having outlined the implications of the various orthographic options, we can now look more closely at the matter of linguistic sophistication and its role in reading English. For this purpose we would differentiate between two aspects of linguistic sophistication—phonological maturity and linguistic awareness (Liberman, Liberman, Mattingly, & Shankweiler, 1980).

Phonological Maturity

To the extent that English is written at the most abstract level, exemplified by the abstract linguistic relationships that rationalize the use of the same alphabetic characters for phonological segments that are phonetically quite different (as in cats and dogs, muscle—muscular, divine—divinity)—to that extent, it assumes an ideal reader who has assimilated the rules in terms of which that sort of spelling makes sense. That is, it assumes a reader who has, to some degree, what we have called phonological maturity.

Unfortunately, younger children may not have the degree of phonological maturity that an alphabetic orthography assumes. This is reasonably clear from the results of psycholinguistic research (Berko, 1958; Moskowitz, 1973) which suggests that young children are, indeed, quite immature phonologically and therefore not well-equipped to take full advantage of the more abstract aspects of the English orthography. Indeed, there is evidence from the invented spellings of preschoolers that young children actually do better as phoneticians than as phonologists (Read, 1975; Zifcak, 1977).

Luckily, while phonological maturity is of some importance in learning to read (and perhaps more so in learning to spell), it is not essential for the beginning reader. Our young phoneticians can learn to read, though perhaps a little awkwardly, mispronouncing a word here and there. We can help them along in these early stages of learning by controlling the vocabulary used in reading instruction (as is done in the so-called linguistic readers)—that is, by providing children with material that avoids the more difficult, less transparent alternations and only gradually increases the level of abstraction as the children show signs of understanding how the alphabet works. Indeed, it is probably experience in reading that, more than anything else, causes developing children to become sophisticated about the more abstract phonological regularities—for example, to realize how "magic" and "magician" are
related. They do this by internalizing the phonological rules they induce from the orthographic transcription and by revising the representations of words in their lexicons accordingly. (Many, that is, will induce the rules; others may need to have the rules pointed out to them.)

Three points should be emphasized here. The first is that it is reasonable to suppose that the more one reads, the more one gains in phonological maturity. The second point is that this gain is possible only if, in reading, one attends to the relation between the printed word and the phonology of the spoken word, that is, if one reads analytically, not globally. One cannot develop this aspect of linguistic sophistication if one ignores the link between the orthography and the linguistic structures it conveys. And, finally, although it requires a linguistically sophisticated reader with a highly developed phonological sense to appreciate fully the extremely abstract way in which some of our words are written, entry into our orthographic system is quite possible without such a high level of that particular linguistic ability. More critical, in our view, for the beginner is the second aspect of linguistic sophistication, namely, the explicit understanding by the reader of the relation in segmentation between the orthography and speech (Liberman et al., 1974).

Linguistic Awareness

Until now we have been talking about the difference between a phonological representation and a phonetic one, and about the phonological maturity that allows the sophisticated reader to relate the two. Now we turn to another difference, that between the phonological domain in general (whether strictly phonetic or phonological) and the sound. In order to relate the phonological domain and the sound, the reader needs the second aspect of linguistic sophistication, what has been called "linguistic awareness" (Mattingly, 1972), that is, the explicit awareness of the segments that are represented by the orthography. As was noted earlier, it is clearly the case that the level of linguistic awareness required of a beginning reader will vary with the nature of the orthography, and, moreover, that entry into the alphabetic orthography, representing as it does the encoded sublexical units of speech, is more demanding than entry into, say, a logography, representing the more easily isolable word.

With all this in mind, we can consider once again the young child who is asked to read the word big. Let us propose that it is part of his speaking vocabulary, but that he has never before seen it in print. In our view, if the child is to map the three letters of the printed word onto the word he already knows (as he needs to do if he is to get from the print to the word), it will be of little use to him if all he is able to do is recognize the three letters, and, as he is often urged to do in "phonics" lessons, to "sound them out." In addition, he must also be helped to understand that the monosyllabic, seemingly indivisible word he knows has three segments, what those three segments are, and the order in which they occur. Unless he does know all that, given the impossibility of pronouncing the segments in isolation, he will produce something like "buh-ih-guh."

The point to be clarified here is that neither this child nor any other reader can recover speech from print on a letter-by-letter basis. What
readers must do instead is to be able to put together the particular string of segments that, in ordinary speech, would be produced as a unit. The unit is commonly a syllable, but the number of letters that form a speakable unit can vary from one to as many as nine. In our view, learning to put together the letters into speakable units is a vital part of learning to read and one that may differentiate the fluent reader from the learner who is just beginning to see what an alphabetic orthography is all about (Liberman, Shankweiler, Liberman, Fowler, & Fischer, 1977).

Given these requirements of linguistic awareness, what can teachers do to ease the way for the beginner? As we see it, their first task is to help the child, as early as possible, to become aware of the segmentation of speech. Elsewhere (Liberman, Shankweiler, Blachman, Camp, & Werfelman, 1980), my colleagues and I have suggested several ways (pleasurable ways—they need not at all be the deadly drills that the "reading for meaning" advocates fear will turn children away from reading) in which this might be done, even in kindergarten, before the letters themselves are introduced. We have suggested beginning with nursery rhymes, word play, and word games, to be followed with any of the numerous activities specifically designed for this purpose by various educators such as Elkonin (1973), Engelmann (1969), and Rosner (1975). Actually, what may be most important at the start is simply to convince teachers that acquainting children with the segmental structure of speech is desirable—the teachers themselves will find countless and ingenious ways of doing it.

Once the children understand about segmental structure (first, perhaps, the words, then the syllables, and, finally, the phonemes), it becomes much easier to teach them how the alphabet transcribes the language. The teacher's next step would be to begin to teach the children the letters of the alphabet, their names, and sounds (see Slingerland, 1971, for an efficient and enjoyable way of doing this). As these are being taught and applied directly in reading and writing, the instruction need not, and, in fact, should not be limited to the traditional letter-by-letter phonics exercises (which are so often, and mistakenly, presented in disembodied lessons entirely separate from the reading class). They need not, that is, be limited to the practice commonly followed of urging the child to "Sound it out; say it faster; blend it." Such a practice may be defensible in the early stages of reading instruction, but only when used with letters like s, m, and n, which can be sounded without the accompanying schwa. It is quite unsuitable, however, for the highly encoded stop consonants (b,d,g,p,t,k) where speed of production will do little to promote blending and continued failure to blend the unblendable may, indeed, turn the child away from reading. We have advocated, instead, various ways in which the teacher can make use of consonant-vowel and vowel-consonant combinations in order to lead the child to map the letters to the phonology and learn, thereby, how to really read words (Liberman et al., 1980). (I hasten to add that these methods are not new—many thoughtful teachers have probably been using similar procedures since reading began. Our aim is simply to encourage their wider use by providing a reasonable motivation for doing so.)
MEANING AND THE WORD IN BEGINNING AND SKILLED READING

The basic task of the readers of any orthography is to get from the printed word to the appropriate word in the lexicon. Though I would, of course, agree that the apprehension of meaning is the ultimate aim of reading, I would wish to emphasize what seems an obvious (but often neglected) fact—that readers cannot apprehend the intended meaning of a sentence unless and until they have apprehended its constituent words. The last question we will address is how this requirement might affect beginning and skilled readers.

The Beginning Reader

I have gone to considerable lengths to show that because the particular speech segment represented by the alphabetic orthography is sublexical and difficult to isolate, the cognitive demands on beginners will be greater (and the task of the teacher harder) and that English further compounds the difficulty for them by the highly abstract way in which it often represents the language. In consequence, I have proposed, as others have (Gleitman & Rozin, 1977; Rozin & Gleitman, 1977), that learning to read will be harder for beginning readers of English than for beginners of Chinese, where the segment to be extracted from the speech stream is the easily isolable word, where any subsequent analysis of the phonological structure of the word is minimal, and where simple paired-associate memory of symbol and word is sufficient for mastery.

Many educators currently concerned with reading apparently disagree. To cite a recent example (Rosner et al., 1981), some would have us believe, instead, that reading is basically "a process of association" and that the problem of the poor beginning reader of English is "symbolization and association." In that view, the dyslexic "experiences difficulty in the association of common experiences and the symbols representing them." Their recommendation for reading instruction is that it "should be meaning-based with a modified language experience approach using content-materials as a vehicle. Word learning in the experience approach should be a whole word procedure for pedagogy."

Since similar views are so widely held, it might be useful to consider them here in some detail. First, is reading a process of association? Well, of course, it can be (though it would be the association of symbols with words, not with experiences—to my knowledge, no orthography uses its symbols to represent experiences). That is, there is nothing to stop a learner from approaching an alphabetic orthography as if it were a logography. Beginning readers of English can, if they choose or are taught to do so, approach their task just as Chinese children do. That is, they can treat the alphabetically written word as if it were a logogram—a graphic pattern like the dollar sign, which bears no relation to the internal segmental structure of the word "dollar." In other words, they can, indeed, adopt a "whole-word" strategy—learning to read by associating each pattern of letters with the word it represents, and presumably using the context to guess at the identity of graphic patterns they have not yet memorized. But by so doing, they will, of course, lose all the remarkable benefits of the alphabetic system. Like Chinese children learning logograms, they will begin to amass a collection of memorized graphic patterns and their associated words. They will not be able
to use the alphabet in the way it was intended, to help them to apprehend new words. For them, a new word will simply be a new graphic pattern to be paired with an associated word, memorized, and added to an ever increasing collection of memorized symbol-word associations. As the collection gets larger, what small advantage there was in starting out this way should certainly soon begin to be lost.

It must be added, in good conscience, that, despite being taught by a whole-word method, some children sooner or later do discover the alphabetic principle on their own; that is, they themselves notice the relationship between how the word is spelled and its phonological structure, and begin to use that knowledge to good effect. We take this as the triumph of their native linguistic ability over the efforts of the whole-word method to keep the principle hidden from them. But what about the many children in our schools who are poor readers or even nonreaders? Is their problem really a defect in associative ability? Since our schools have been introducing reading by a kind of whole-word method for many years (by teaching children to memorize an introductory set of symbol-word associations to be triggered by picture- and story-context), one must wonder whether the problem of many of our poor readers was that they continued doggedly with the whole-word, logographic strategy, never managing to see the alphabetic principle on their own, and thus falling farther and farther behind their more perceptive classmates or finally giving up.

In any event, I would seriously question whether the poor reader's problem is one of symbolization or association. I know of no evidence that would suggest that this is really the case, and considerable evidence to the contrary. For example, learning disabled children who have never been able to master an alphabetic orthography readily learn to pair Chinese-like characters with their associated words and then to read off strings of them that have been arranged to form sentences (Roizin, Poritsky, & Sotsky, 1971). Moreover, a recent study (House, Hanley, & Magid, 1980) has shown that even retardates with a mental age of five or even less, who had never been able to learn to read, can be taught to identify and remember 200 or more pseudologograms and then to read them correctly when they appear in sentence form. They are simply taught to pair a visual pattern with a word and to memorize the association between the two. Surveys of dyslexia research also abound with many studies which strongly demonstrate that disabled readers have no difficulty at all in paired-associate memory (see Vellutino, 1979, for a recent review). In contrast, poor analytic linguistic abilities (as in phoneme and even syllable segmentation) are consistently found to be related to and predictive of poor reading achievement (Blachman, 1981; Calfee, Lindamood, & Lindamood, 1973; Goldstein, 1976; Golinkoff, 1976; Liberman & Mann, 1981; Lundberg, Olofsson, & Wall, 1980; Treiman & Baron, 1981).

Now what about the notion that "reading instruction should be meaning-based with a modified language experience approach"? As I have said earlier, it seems obvious that the meaning of a word cannot be apprehended without first apprehending the word itself and that the meaning of sentences and paragraphs cannot be apprehended without first apprehending their constituent words and grammatical structures.
Here it is useful to emphasize again that a word is something apart from its meanings. One does not have to know the meaning of a word in order to be able to read it (or to say it, for that matter). One can read a word like blastoderm but not know its meaning and therefore have to look it up in a dictionary or ask someone for its meaning. On the other hand, one can read a word like club and know several meanings for it, but have to determine from the context which meaning the author intended. In the first case, one must depend on a dictionary or a knowledgeable person for the meaning; in the second case, one can use one’s own knowledge to arrive at the meaning. But in either case, before one can get to the meaning of the word represented by the print, one must first get from the print to the word. And modified or not, a language experience approach will not inform our readers how to get from the print to all the new words they encounter.

The Skilled Reader

So much for the beginning reader. What of the skilled reader? The received view in educational circles appears to be that once you are a skilled reader, you have found some miraculous way of discovering what the writer said, without first recovering what he actually said, and that the less you get of the information provided you by the print, the more skilled you are, because you are faster (Goodman & Goodman, 1979; Smith, 1973). As for the psychological literature on reading, much of the discussion there swirls around whether you arrive at the information in the print by an acoustic code, by a phonetic code, by a visual code, or by some interactive method in which you rely heavily on context but do examine words as you need to do so.

I would say again in response to all this that the acoustic signal is not represented by the alphabetic orthography, so all talk of an acoustic code is irrelevant. As to a phonetic code, the exact phonetic information, as we have seen, is also not represented in the alphabetic orthography and, indeed, there are few instructions in the print as to exactly how to produce it. It is just as hard to see how a visual code would work. The linguistically relevant information is not given by the overall optical configuration of the word nor by the optical shapes of the letters (the ascending, descending, diagonal, or circular characteristics of the squiggles on the page). As to the interactive approach, its proponents seem to be suggesting that in reading a passage, the skilled reader can go along deciding whether to read a word or whether to use the context to guess at it. In my view, if you are a skilled reader, your reading of words is automatized; you cannot keep yourself from reading the words. You cannot go along deciding whether you will read the word or will instead guess its identity from the context. You do use the context on occasion, of course—for example, when you are jarred by a conflict between a word you have read and the meaning of the rest of the words in the sentence or perhaps to determine the meaning of a word you have read. But in both cases, you will have read the words. This is not to say that a skilled reader cannot skim through a book or passage, reading a word here and there, or that he cannot skip over the long polysyllabico, hard-to-pronounce names in Russian novels. But in neither case is he using the context to get at the word. In the first case, he is actually reading words to get the meaning and in the second case, he is simply not reading.
Now to get back to what the skilled reader does do when he reads. Since an alphabetic orthography represents linguistically relevant aspects of the internal structure of the word, the reader, no matter how skilled he is, misses a lot if he ignores it.

What is he missing? The internal structure of the word can provide information about its derivational status and the constituent morphemic elements of polymorphic words. It can provide information also about its grammatical status—for example, the tense, case, and number of the words and the effect of prefixes and suffixes on them. If you are going to get all that information from the printed word, you are well advised, in reading the word, to apprehend the internal structure which is, in fact, represented by the letters. Even if you have seen the word a million times, you nonetheless need to take account of its structure, if you are properly to understand what you read.

In this section, I have tried to answer three questions about what the skilled reader does. First, does he go directly to meaning or does he read the words? Second, if he bothers with the words at all, does he guess at what they might be from the context and pay attention to them only when all else fails? And third, does he read words as wholes or does he pay attention to their internal structure? In my view, it is the poor reader (and the beginner) not the skilled one, who attempts to go directly to meaning, who guesses frequently at words from the context, and who reads words as wholes. The skilled reader, in contrast, attends to the words and their phonological structure, and guesses only rarely (see Gough & Hillinger, 1980; Perfetti, Goldman, & Hogaboam, 1979).

In sum, if they are to make best use of an alphabetic orthography, both the skilled reader and the beginner must apprehend the internal structure of the word. The skilled reader does it quite automatically, and beginners, though it may be difficult for them, should be given directed instruction toward that end from the start. That is, they should be instructed from the start as to just how the orthography represents words. They should not be taught as if reading were a matter of associating a visual shape with a meaning or as if reading can be mastered without learning how to use an alphabetic orthography properly, or as if it should depend heavily on guessing from shape and context. As I have tried to show, such notions surely go against all we know about language, the orthography, and the reading process.

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