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Auditory Processing and Language

Clinical and Research Perspectives

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Steps Toward Literacy: A Linguistic Approach*

The reading curricula commonly used in our schools appear to us not to take advantage of an important and readily available body of knowledge about the relationship between reading and the spoken language. That is unfortunate, if, as we believe, much of that knowledge might be put to good use in the prevention of reading failure. In the first section of this chapter, we will, by way of background, review some relevant information, particularly that which concerns the way in which an orthography transcribes the language. We will also describe associated research results, together with the more general view of the reading process that they support. In the second section, we will develop the implications for reading instruction.

We should emphasize that we do not intend to present a reading curriculum with all the detail that such an undertaking would require. What we can offer are guidelines for early reading instruction that are consistent with what is known about linguistic factors in reading, including mainly that research in which we have a special interest.

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SPEECH, THE ALPHABET, AND LEARNING TO READ

Reading and the Spoken Language

We assume at the outset that reading is intimately related to and, indeed, dependent on speech. We are led to this assumption by several observations that seem obvious and compelling.[1, 2] First, speech and reading both have to do with language: speech is language for the ear, while reading is language for the eye. But speech is unquestionably the primary language system while reading is secondary. Speech is universal, while reading is rare among many of the world's peoples. Speech was first in the evolution of man, while reading was second and a comparatively recent development in man's history. Speech is also first in the history of the individual while reading comes second. Speech is, moreover, remarkably easy for humans to acquire. Infants are already listening discriminatively to speech by the age of one month,[3] and most two-year-olds are already beginning to speak intelligibly. Speech apparently requires little tuition, only an input of linguistic data and an opportunity to interact with those data. In contrast, reading is difficult and ordinarily is not acquired unless taught.

The second observation that leads to the assumption that reading is dependent on speech has to do with the nature of the writing system. We all know that human language is distinguished from other communication systems by the fact that it is phonemic. That is, all human languages are composed of commutable segments that have no meaning in themselves. These segments, called phonemes, can be transmitted either by ear or by eye—that is, by spoken or written language. An alphabetic writing system, such as English, is a more or less accurate representation of the phonologic structure of the spoken language; it is not, as some educators seem to believe, a symbol system keyed directly to meaning.

Finally, evidence to support the contention that speech is an essential foundation for the acquisition of reading is seen in the remarkably poor reading achievement of the congenitally deaf. We know that these children, who are blocked in the acquisition of speech, do not readily learn to read even though they have complete access to the printed word through the visual channel.[4]

In summary, reading is parasitic on speech and cannot be reasonably considered apart from speech.[5] If reading and speech are so closely linked, it is surely unparsimonious to imagine a completely parallel language understanding system for reading that borrows nothing from the primary speech system. We assume, therefore, that the reading process must necessarily tie in with the speech system at some point. The way in which this is done will depend on the nature of the writing system.

Reading and the Writing System

How does the nature of the writing system affect the task of reading acquisition? Before we can answer that question, we must first consider in what ways the spoken language can be represented by its written counterpart. To write a language, one must decide which of its several kinds and sizes of segments should be represented.[6] The choice of kind arises from the fact that all languages have a dual structure—segments that have meaning and segments that do not. Each kind of segment offers its own set of options in size. For example, meaningful segments can be as long as sentences or as short as words. Among the meaningless segments, the most likely candidates for a writing system are syllables and phonemes, the latter being the shortest segments of all.

THE HISTORICAL DEVELOPMENT OF WRITING

In the historical development of writing, systems that used meaningful units came first.[7, 8] Some were historically related; others developed independently. Something like the word was the segment most commonly represented. The Chinese ideographic characters and the kanji characters of Japanese are present-day examples of this method. In these writing systems, a single character or symbol denotes a word.

Writing systems based on meaningless units are a more recent development. Among these, the segment size that was represented in all the earliest systems was the syllable. In these writing systems, as in the present-day kana part of Japanese, a single character denotes a syllable ('ba, be, bi, bu, ga, ge, gi, gu', for example). An alphabet, representing segments of phonemic size ('b', 'a', 't', for example), was developed much later. It is clear, moreover, that the alphabet developed historically out of a syllabary and, furthermore, that this important development, quite unlike the others, occurred only once. All subsequent alphabets are derivations of the original one invented by a Phoenician trader.

ABSTRACTING THE UNIT TO BE REPRESENTED

Writing systems, as we have noted, can represent the spoken language by segments of different kinds and sizes. However, whatever the kind or the size of the segment, it is obvious that the inventor of the writing system must first have succeeded in consciously abstracting that unit from the acoustic stream of speech. What does the history of writing systems tell us about this? As we have pointed out, writing systems based on meaningless units, the syllables and phonemes, were late developments in the history of written languages. The alphabetic system, which requires the abstraction of the phonemic unit of speech, was the last to appear; it evolved from a syllabary and, in contrast to other systems, was apparently invented only once.

It seems reasonable to suppose that this historical progression from word to syllable to phoneme might reflect the ease (or difficulty) of abstracting segments of a particular type from the speech stream.[9] From this it would follow that the order of difficulty of segmentation would be: the word, the syllable and, hardest of all, the phoneme. More to the point of this paper, we should suppose that for the young child learning to read, there might be the same order of difficulty. That is, the child learning to read in an alphabetic system may be faced with the most difficult level of analysis in the early stages of attaining literacy. In the next section, we will explore this question in more detail.

Reading Acquisition and the Alphabet

In languages that are written alphabetically, the unit characters or letters are keyed to the phonologic structure of speech. We are aware that the mapping from written symbols to phonemes is more nearly one-to-one in some alphabetic languages, such as Finnish and Serbo-Croatian, than in English. The many departures from one-to-one mapping makes English difficult to spell, and probably more difficult to learn to read, than is the case in languages whose alphabetic writing systems have a more regular structure. Nonetheless, it is important to underscore the fact that English spelling, in common with other orthographies that employ an alphabet, is, for all its peculiarities, a cipher on the phonemes of the language.[2]

THE ADVANTAGES OF THE ALPHABET AND AN ANALYTIC STRATEGY

The child's fundamental task in learning to read is to construct a link between speech and the alphabetic cipher. It is appropriate at this point to remind ourselves of the benefits that alphabets confer.[10, 11] A unique advantage of an alphabetic system is that each new word does not have to be memorized, as if it were an ideographic character, before it can be read. That is, given a word that is already in his spoken language, the reader can apprehend the word without specific instruction, although he may never have seen it before in print. Or, given a word that he has never before seen or heard, he can closely approximate its spoken form until its meaning can be inferred from context or discovered later by asking someone about it. The letters, by functioning however roughly as surrogates for phonemes, enable users of the alphabet to gain immediate access to all items in a vast word store by means of a highly economical set of symbols.

The savings may be had, however, only by the user who knows how the alphabet works. As in all complex cognitive skills, alternative strategies are possible. The very diversity of the orthographies that have developed during the course of the evolution of writing is testimony to the flexibility of the perceptual apparatus. It is, of course, possible to read words written by an alphabet as though they were ideographs. Many children undoubtedly begin reading acquisition in this way.

THE NEED FOR EXPLICIT AWARENESS OF THE PHONEMIC LEVEL

The unique advantages of the alphabet, however, are closed to the child who cannot use it analytically. Although alphabetically written words can be treated as ideographs, using such a strategy will not help the child to apprehend new words. In order to make the alphabet work for them, children have to be able to make an explicit analysis of the phonemic segments of the spoken language. First, they must realize that speech can be segmented into phonemes, and they must know the number of phonemes the words in their vocabulary contain and the order in which they occur. Second, they must know that the letter symbols represent phonemes and not syllables or some other unit of speech. This sort of explicit awareness of the phonemic properties of speech is a precondition for understanding the alphabetic principle.

When we speak of explicit knowledge of the segments in the spoken message, we wish to make it very clear that something more is involved than the ordinary competence required in language use. That is to say, a person may be a completely adequate speaker-hearer of his language without having any awareness that the spoken word 'bet' contains three phoneme segments, and 'best' contains four. The immediate recognition of these as different words, in the absence of the ability to indicate that 's' is the unshared segment, is an example of what Polanyi[12] has called "tacit knowledge." Such knowledge is sufficient for comprehension of the spoken message. Writing and reading, on the other hand, demand an additional analytic capability, as will be pointed out later in some detail.

THE DIFFICULTY OF EXPLICIT AWARENESS OF PHONEME SEGMENTATION

There are several lines of indirect evidence which suggest that this needed awareness of the structure of the spoken word is not readily attainable by the child. The first, the historical development of writing systems, has already been discussed. Another relevant finding is that children with reading disabilities often have difficulties even with spoken language when they are required to perform tasks demanding some degree of conscious segmentation of phonemic structure. For example, these children are often reported to be deficient in rhyming, in recognizing that two different monosyllables may share the same first (or last) phonemic segment,[13] and according to recent research,[14] in speaking Pig Latin, which demands a conscious shift of the initial phonemic segment to the final position in the word.

A third line of evidence is provided by the behavior of reading disabled children as observed by teachers who have worked with them.[15] These children will demonstrate, as we have suggested earlier, that they can readily recover the phonemic segments in the ordinary course of speaking and listening. That is, they can respond appropriately to spoken words and to the objects to which they refer. Moreover, they can approximate the letter-to-sound correspondences. For example, if they are asked to give the sound of the letter *b*, they will say "bŭh". For the letter *a*, they will say "ă" (although this may give them more trouble, as we will discuss later). For the sound of the letter *t*, they will say "tŭh." But if they are shown the printed word *bat*, and asked to read it, they may give any one of a variety of incorrect responses that begin with the letter *b*, but otherwise bear little relation to the original word. If they are pressed to try to "sound out" the word, or otherwise to use what they know about the letter-to-sound correspondences, they are likely to produce "bŭhătŭh." At that point, they may be urged by the teacher to "say it faster," to "put the sounds together," or, in the phrase commonly used, to "blend it." But no matter how fast they produce those sounds or how desperately they try to put them together, they often produce the nonword "bŭhătŭh", containing five phonemic segments, and not the word 'bat', which has only three. Somehow they cannot relate the three letters of the printed word to the three phonemic segments of the spoken word. It is as if they were not aware of the fact that the monosyllabic spoken word has three segments.[9]

AN EXPLANATION FOR THE DIFFICULTY OF ABSTRACTING PHONEMIC SEGMENTS

Why should it be so difficult for the child to become explicitly aware of phonemic segmentation? If, as has often been supposed, the sounds of speech bore a simple one-to-one relationship to the phonemic structure of the language, just as the letters do (at least in the orthographically regular case), it would indeed be hard to see why phonemic analysis should pose special problems. That is, if there were in the word 'bat' three acoustic segments—one for each of the three phonemes—the segmentation of the word that is represented by its spelling would be readily apparent.

However, extensive research in speech perception has shown that the segmentation of the acoustic signal does not correspond directly or in any easily determined way to the segmentation at the phonemic level.[5, 16, 17] Moreover, this lack of correspondence does not arise because the sounds of the phonemes are merely linked together, as are the letters of the alphabet in cursive writing (or as may be implied by the reading teacher who urges the child to blend "bŭhătŭh" into a word that he knows). Instead, the phonemic segments are encoded or merged at the acoustic level into essentially unitary sounds of approximately syllabic dimensions. In the case of 'bat', for example, the initial and final consonants are folded into the medial vowel, so that

information about the successive segments of the word is transmitted more or less simultaneously on the same parts of the sound.[18] In exactly that sense, the syllable, 'bat', which has three phonemic segments, has but one acoustic segment in which the phonemes are merged.[9]

The merging of phonemes in the speech stream complicates the process of discovery of the phonemic structure of speech for the would-be reader. However, we should emphasize again that the child who finds it difficult to make explicit the phonemic segmentation of his speech need not have any problems at all with speaking and listening. Children generally distinguish (or identify) words like 'bad' and 'bag', which differ in only one phonemic segment. Indeed, there is evidence that infants at one month of age discriminate sounds categorically.[3] (Chapter 3). The child has no difficulty speaking and listening to speech, because segmentation of the largely continuous acoustic signal is done automatically by operations about which he is not conscious.* In order to speak and listen, the child need have no more conscious awareness of phonemic structure than he has of syntactic structure. In that connection, we all know that a child can speak grammatical sentences without being able to explicate their structure. Similarly, he can readily distinguish 'bad' from 'bag' without being able to analyze the underlying phonemic structure—that is, without an explicit understanding of the fact that each of these utterances consists of three segments and that the difference between them lies wholly in the third segment. But reading, unlike speech, does require a more explicit analysis if the advantages of an alphabet are to be realized.[10, 11]

The encoded nature of phonemes has another consequence that contributes to the difficulty in learning to read analytically; it is impossible to read by sounding out the letters one by one. In the example of 'bag', used above, reading letter by letter gives not "bag", but "bŭhăgŭh." In order to learn to read analytically, one must achieve something altogether different: one must discover how many of the letter segments must be taken into account simultaneously in order to arrive at the correct phonetic rendition. In the case of the word 'bag', there is reason to believe that the number would be three. But, in fact, there is no simple rule for arriving at that number, and we suspect that learning to group the letters for the purpose of proper phonetic recoding is one of the really significant skills a reader must acquire. Even in languages like Finnish and Spanish, in which the writing system closely approximates a one-to-one correspondence between letters and phonemes, reading cannot be a simple matter of association between alphabetic character and spoken sound. In order to recover the spoken form, the reader must chunk all the letters that represent the phonemic segments encoded into each syllable. In the case of reading a word in isolation, the coding unit is probably the syllable.[10, 11]

*This may not be the case for some children who have difficulty acquiring speech and language. In these cases, it may be necessary to make the structure explicit to facilitate learning of the spoken language. See Chapter 7.

THE RELATIVE EASE OF SYLLABIC ANALYSIS

If it is now apparent why explicit segmentation into phonemes might be difficult, it is still reasonable to ask why syllables should be easier.[9] A plausible answer is not hard to find. As we noted earlier, the consonant segments of the phonemic message are typically folded, at the acoustic level, into the vowel. The result is that there is no acoustic criterion by which the phonemic segments are dependably marked. However, every syllable that is formed in this way contains a vocalic nucleus and, therefore, a peak of acoustic energy. These energy peaks provide audible cues that correspond to the syllable centers.[19] Though such auditory cues could not in themselves help a listener to define exact syllable boundaries, they should make it easy for him to discover how many syllables there are and, in that sense, to do explicit syllabic segmentation.

If syllabic segmentation is easier, we then have an explanation for the assertion that the Japanese kana is readily mastered.[20] The kana is one of the two Japanese writing systems, and is approximately a syllabary. Most of the graphic symbols in the kana represent a syllable, as we have said. There are separate symbols for ba, be, bi, bu, ga, ge, gi, gu, and so on. Given the open syllable (CV) structure of the Japanese spoken language, the child, therefore, rarely needs to go below the level of the syllable in order to master the writing system. Similarly, an orthography in which each character represents a word (as is the case in Chinese ideographs or in the closely related Japanese kanji) should also be easier for the beginning reader, at least sparing him the particular difficulties that arise in mastering the more analytic alphabetic system. Indirect evidence of the special burden imposed on the beginning reader by an alphabetic script can be found in the relative ease with which reading-disabled children learn kanji-like representations of language while they are unable to break the alphabetic cipher.[21]

THE DEVELOPMENTAL PROGRESSION OF SEGMENTAL ANALYSIS

There is a growing body of empirical evidence that demonstrates more directly that phonemic segmentation is harder than syllabic segmentation, and that the ability to do it develops later.[6, 22-24] These findings are typified by a recent investigation by our research group.[6] The point of our study was to determine how well children in nursery school, kindergarten, and first grade (four-, five-, and six-year-olds) can identify the number of phonemic segments in spoken utterances, and how this compares with their ability to deal similarly with syllables. The procedure was in the form of a game that required the child to indicate, by tapping a wooden dowel on the table, the number (from 1 to 3) of the segments (phonemes in one group, syllables in the other) in a list of test utterances.

At age four, none of the children could segment by phoneme, whereas nearly half could segment by syllable. The ability to carry out phoneme segmentation successfully did not appear until age five, and then it was demonstrated by less than one-fifth of the children. In contrast, almost half of the children at that age could segment syllabically. Even at age six, only 70 percent succeeded in phoneme segmentation, while 90 percent were successful in the syllable task.

SEGMENTATION ABILITY AND READING SKILL

The difficulty of phoneme segmentation and its possible importance as an entry behavior for reading acquisition has been affirmed by many investigators besides ourselves.[14, 24-31] We explored this question directly by measuring the reading achievement of the children who had taken part in our experiment on phoneme segmentation. We tested our first graders at the beginning of their second school year and found that half of the children in the lowest third of the class in reading achievement had failed the segmentation task the previous June. On the other hand, there were no failures in phoneme segmentation among children who scored in the top third of the class in reading ability.[6]

A number of new studies now confirm these results.[32-35] Despite widely varying school populations (from black disadvantaged to white middle-class school children) and quite diverse experimental procedures, each of these studies shows a high and significant correlation between success in phoneme segmentation and early reading ability. All of these studies suggest that the ability to analyze speech phonemically is indeed relevant to success or failure in learning to read. The results lend encouragement to the hypothesis that segmentation ability may be critically associated with reading acquisition.*

THE PATTERN OF READING ERRORS AS INDICATORS OF PROBLEMS IN READING ACQUISITION

We have suggested that a lack of awareness of phonemic segmentation may be one serious roadblock to reading acquisition. There are data from the analysis of children's reading errors that appear to provide additional indirect evidence for this view. It seemed to us[9] that if a child's chief problem in reading is that he cannot make explicit the phonemic structure of the language, he might be expected to show success in identifying the initial letter of words (requiring no further analysis of the syllable), and relatively poor performance beyond that point. If all he knows are the letter-to-sound corre-

*In a recent study, it was reported that adult illiterates had difficulty in carrying out phonemic segmentation of spoken words, whereas others from the same community who had learned to read as adults were able to perform segmentation tasks.[35] These findings suggest that literacy training, and not maturation alone, may be critical for the development of conscious awareness of phonemic structure.

spondences and that he must proceed from left to right, he might in the case of 'bat', for example, simply pronounce the phoneme corresponding to the first letter, and then search his lexicon for a word beginning with that phoneme. Of course, what he needs to do instead is to search his lexicon for a word that has three phonemic segments corresponding to the letter segments in the printed word. However, if he does not know that the words in his lexicon have segments or if he finds phonemic segmentation difficult, he will not be able to map the letters to the segments in those words. By this reasoning, his errors on the final consonants in words should be greater than those on the initial consonants.

That is precisely what we found in a series of experiments on the reading of monosyllabic words by second, third, and fourth graders.[9, 36, 37] There was indeed a progression of difficulty related to the position of the segment in the word with the final consonants being misread twice as frequently as the initial consonants. Similar findings have been reported by other investigators who examined error patterns in the reading of connected text.[38, 39]

VOWEL ORTHOGRAPHY AS ANOTHER SOURCE OF DIFFICULTY

So far we have presented several lines of evidence suggesting that the explicit analysis of phoneme segmentation is a hard and unnatural task that may be an important source of difficulty for the child learning to read. But it is certainly not the only serious barrier. The error pattern for reading vowels provides a case in point.[11] It is well established that in English vowels elicit many more errors than consonants.[11, 13, 39, 40] In the reading errors study described above, for example, the vowel errors were roughly twice as frequent as the overall consonant errors.

Why should the error rate for reading vowels be so much higher than that for consonants? It might be simply because of the embedded medial position of the vowel in the words used to test reading. To check on this possibility, we devised a new reading test consisting of equal numbers of words containing vowels in the initial, medial, and final positions. It was found that the overall rate of vowel errors continued to be about twice that of consonant errors, regardless of vowel position in words.

There are two reasons for suspecting that vowel errors may reflect something more than the segmentation problems we discussed in relation to consonant errors. First, as we have seen, the child can apparently count syllables fairly well, and the vowel nucleus stands out in the spoken word as a major element that can be identified in the syllable. A second, and perhaps more interesting reason, can be seen from further examination of the error patterns. In the case of consonants, errors tend to pile up in the final position. We have

taken this to be indirect evidence that the child is having segmentation problems. Vowel errors, on the other hand, are different. In our error studies, there was no significant difference in error rate for vowels whether they occurred in the initial, medial, or final position. Moreover, the error rate of vowels in both initial and final positions continued to be significantly higher when compared with consonant errors in corresponding positions. In English, there is clearly no position effect evident in vowel errors; they are simply difficult in all positions. Thus, the vowel problem certainly cannot be entirely attributed to segmentation difficulties.

We suspect that the errors elicited by consonants and those elicited by vowels are quite different in their origins. In the case of consonants, the child has little trouble learning the spelling-to-sound correspondences. Furthermore, orthographic complexity makes no appreciable difference to the position effect of consonants. The child's error pattern there arises mainly from the fact that he cannot map the segmentation of the printed word to the segmentation of the spoken word.

The extra difficulties attendant upon the vowels are probably due in part to the obvious orthographic complexities of the spelling-to-sound correspondence for vowels,* but also partly to the continuous and fluid nature of vowel perception.[5, 18] Although it stands out wherever it occurs in speech, the vowel can be spelled in many ways in the English writing system, and is less categorically perceived than the consonants. That is, not only is there a many-to-one mapping of spelling-to-sound (*a* may have the sound 'ă' as in 'cat' or 'a' as in 'baby'), but also there is the continuous nature of vowel perception, which makes the sound correspondences of single vowel letters harder to code and to maintain in memory. We have argued that because of the continuous nature of their perception, vowels tend to be somewhat indefinite phonologic entities.[37] This is also illustrated by the major part they play in the variations among dialects, and the persistence of allophones within a geographic locality. By this reasoning, it could be that the less strongly categorical nature of vowel perception may itself be one cause of the complex orthography for vowels, and at least one reason why multiple representations of vowels are tolerated.

Although we believe that it is of interest to investigate the causes of vowel errors, we recognize that the vowel may be less important in the process of reading acquisition than would first appear. It could be argued that if the child's segmentation problems were corrected, his difficulties with

*In this connection, it is of interest to report that though the position effect in the consonant error pattern has been replicated in the reading of Serbo-Croatian words, the vowel error rate did not exceed the consonant rate; indeed, it was significantly less. Serbo-Croatian differs from English in two respects that are relevant here—the vowel set is limited to five vowels and the written language is orthographically extremely regular.[56]

vowels would not be a serious barrier to reading acquisition. Consonants carry most of the information load. If the child knew how many consonants there were and their sequence in the spoken word, an incorrect rendition of the vowel sound would be fairly easily corrected in the context. Getting only the vowel correct, without a proper analysis of the phonemic sequence of the word, would be of less benefit to him.

Theoretical Summary

We believe that the priority of spoken language and the recognition of how reading and writing are derived from it are the starting points for any understanding of writing systems and their acquisition. Reading presents special problems for the perceiver; these problems reflect the manner in which the writing system makes contact with the primary speech system. In the case of English, the ties between the language and its spelling are based in part at least on the phonemic structure. Therefore, it is particularly appropriate to direct the child's attention to the phonemic level of language because the phonemic correspondences are the entry points to any alphabetic writing system.

In order to learn to read an alphabetically written language, the child must have the ability to make explicit the segmentation of his own speech, particularly at the level of the phoneme. Data were presented that indicate that explicit awareness of the phonemic structure is difficult to attain; this is in contrast to the tacit appreciation of phonemic contrasts reflected in ordinary language use. We and others have shown that the capacity to abstract the phonemic segment is lacking in many children when they start to learn to read, and may contribute to reading failure. The vowel orthography poses other, additional problems.

The relationships between speech and reading are both intimate and subtle. It would seem appropriate for the early instruction in reading to take these factors into account if the child is to master an alphabetically written language.

SPEECH, THE ALPHABET, AND TEACHING TO READ

It has become fashionable to say that very little is known about how to teach reading, and that the teacher makes a greater difference than the method. We would agree that the flexibility and wisdom teachers show in adapting existing curricula to meet individual differences, as well as their ability to recognize the necessity for doing so, will always be important variables in the success of any instructional procedure. However, we would also maintain that

the little we do know about reading is often not reflected in reading curricula. If it were, even the less creative teacher might be more successful, and the proportion of children resistant to reading instruction might be decreased.[2]

To take a very basic example, consider what we know about our writing system—namely, that it is alphabetic and not ideographic. From this, it follows that instructional procedures should inform the child from the very beginning that the printed word is a model of the ordered string of component phonemes in the spoken word and their particular succession. Conversely, it would follow that the instruction should not, as it often does, mislead the child into assuming that the printed word is an ideographic symbol—a notion that will have to be corrected later, and, apparently for some children, with great difficulty.

Procedures of the sort that initiate the child into the mystique of reading by drawing his attention to the visual configuration ("remember this shape; it has a tail") and its associated meaning ("the one with the tail means monkey"), without alerting him to the relevance of the phonemic structure of the word, may be sufficient for some children. Somehow, these children abstract the alphabetic principle on their own. For too many others, however, such procedures, which emphasize meaning at the outset without instruction in how an alphabet works, lead into a blind alley. The ability of the child to memorize the shapes and associated meanings of a handful of words may lull him at first into the comforting belief that he can read, but then leave him stranded at that stage—a functional illiterate with no keys to unlock new words.

What is needed is an instructional sequence that will unlock the alphabetic cipher and the world of reading for the large proportion of school children who are not learning to read by our present procedures. The same instructional sequence can be used for the quick learners as well, provided a few general principles of instruction are followed.

General Principles of Instruction

There are several interrelated principles, applicable to all classroom instruction, that are, in our view, particularly critical for successful reading acquisition. These principles are not original with us; indeed, they are probably as old as teaching itself. However, we believe they should be emphasized at the outset because, in reading instruction in our schools, they tend to be honored more often in the breach than in the observance. Ironically enough, they are typically brought into play during remedial instruction after the child has failed. The child is then said to have been resistant to ordinary methods of instruction. We suspect that if the ordinary methods of instruction had been based on these principles, the children would have been considerably less

resistant. We should add that what follows is only a brief sketch of the general principles to be considered. An exhaustive treatment of the subject would require a position paper of its own.

The *first principle* is that essential skills should be taught as directly as possible with clear explanations of what is being taught. The child should not be expected to develop fundamental skills on his own by a discovery method. Though some children undoubtedly can do so, too many will fail. Those who learn quickly need not be penalized for their early success as might be feared; at the same time, the ones who have difficulty will be given a chance to acquire the information they need. This will be true, however, only if a *second principle* is observed: all procedures must be individually tailored in such a way that no child need linger at a given step after he has mastered it. This brings us to a *third principle*, the need for mastery. By mastery, we mean a high level of accuracy in the skill being taught. Too often in present day practice, a fundamental skill is introduced almost casually in one or two pages of a workbook and followed similarly by a series of additional skills in rapid succession. Instead, the understanding that is needed should be developed through as much practice and reinforcement as is required for that particular child, and all new material in a skill sequence should be preceded by a review of what has already been learned. An important *corollary of the mastery principle* is that of automatization. Mastery can imply accurate performance without regard to rate. In reading, accuracy is not enough. The accurate, but slow reader is at a considerable disadvantage. Therefore, effort should be directed toward making component skills as automatic as possible. As in all learning, practice is the key to automatization in reading acquisition.

Preparing the Child for the Alphabet

Teaching a child how to use an alphabetic system to its fullest advantage is complicated by the difficulty young children have in explicitly understanding the phonemic structure of speech. As we have said, phonemic analysis is hard because of the encodedness of spoken speech into units of syllabic size, while syllabic segmentation is much easier. However, it need not follow that the phonemic level of analysis should be bypassed entirely in favor of the syllable or the word. Instead, the child can be given a better preparation for abstracting phoneme segments both before and during reading instruction.

WORD PLAY IN EARLY CHILDHOOD

For many children, the groundwork for this difficult level of analysis begins at home before the child is old enough to go to school. Ideally, it should be extended to all preschoolers. A proper foundation laid at this time

can be built upon in the prereading stages of kindergarten and at each succeeding stage of reading acquisition. Word games in early childhood that draw the child's attention to the segmental nature of his spoken language and that give him extended practice are therefore recommended. Examples of such word play include the learning of nursery rhymes and the introduction of rhyming games that use both real words and nonsense syllables. Rhyming activity makes few semantic or syntactic demands on the child while giving him practice in varying the phonemic content of utterances.

PREREADING TECHNIQUES

When the child reaches kindergarten, prereading techniques can be initiated that stress the structure of the spoken language before the instruction in the alphabet is begun. Since the word and the syllable are more readily abstracted than the phoneme, these are the structural elements of choice to introduce the child to the notion of listening for component parts of the speech stream.

Segmenting the word and the syllable. To make the *word* explicit for the child, a counting game suggested by Engelmann[41] would be useful. In this game, the teacher presents simple statements orally (for example, "John is happy"), which the child repeats. Then she says the statement again, pausing between each word, and demonstrating how to represent the number of words concretely by raising her fingers, by making chalk slashes on the board, or by using blocks as counters. The sentences can be made increasingly complex by including modifiers and function words.

Once the child understands by this method or others that the stream of speech contains word elements, the teacher can introduce the idea that the words themselves are composed of smaller units, the *syllables*. Compound words are useful at this stage of instruction (for example, "Say cowboy without the cow"), as recommended by Rosner.[33] Syllabic segmentation can be further developed with other multisyllabic words. In this case, the teacher might say the word first at a natural rate, then with short pauses between the syllables. The children are asked to repeat it after her in the same way.

Segmenting the phoneme. Instruction in abstracting segments at the level of the word and the syllable presents few problems. The word and syllable share a common characteristic—both of these segments can be separated from the speech stream with little damage to their identity as units. The teacher can accomplish this separation, as we have said, simply by pronounc-

ing the segments individually with pauses between them. The encoded nature of the phoneme makes this kind of artificial separation of the unit more difficult.

Teacher-devised listening games can nonetheless be used to good effect in teaching phonemic segmentation. Too often in our kindergartens, they are haphazardly organized, concentrating on the initial consonants of words, and paying only scant attention to the phonemes in medial and final positions. But when they are appropriately sequenced, they can be very successful. In one such program,* a kindergarten teacher initiated prereading instruction by first teaching the children to listen for the five short vowel sounds in words. Among the games she described is one which seems particularly useful. In the first stage of the game, the teacher says a given vowel sound once ("ă"), twice ("ă ă"), or three times ("ă ă ă") and asks the class in each case to raise as many fingers as sound they have heard. After the children can do this correctly with all the short vowel sounds, she adds a final consonant to the vowel, thus producing vowel-consonant (VC) syllables ("am, it, op"). She intersperses these syllables with single phonemes of the previous lesson and again asks for finger raising. She then progresses to consonant-vowel (CV) syllables, then to CVC, CCVC, and so on, varying vowels and consonants at each stage as needed. Howard reported that after instituting this speech analysis program in the Fall, she could begin teaching reading much earlier and with greater success than ever before.[42]

The Elkonin procedure. Several auditory training programs that emphasize the analysis of syllables into phonemes (rather than the discrimination of nonspeech sounds) have been available commercially for some time. *Auditory Discrimination in Depth* is an example of this type of program.[43] None, to our knowledge, has as many worthwhile features as that outlined by the Soviet psychologist, Elkonin (Fig. 10-1).[28]

In the procedure described by Elkonin, the child is presented with a line drawing of an object which reliably elicits a word in the child's active vocabulary. Below the picture is a rectangle divided into sections equivalent to the number of phonemes in the pictured word. The child is taught to say the word slowly, putting a counter into the appropriate section of the diagram as the word is pronounced. After this game has been played with many different pictured words and the child can do the task successfully without the diagram, the idea of vowel and consonant sounds is introduced. At this time, the color of the counter is differentiated for the two phonetic classes; say—pink for the vowels and white for the consonants. Having first been taught the difference

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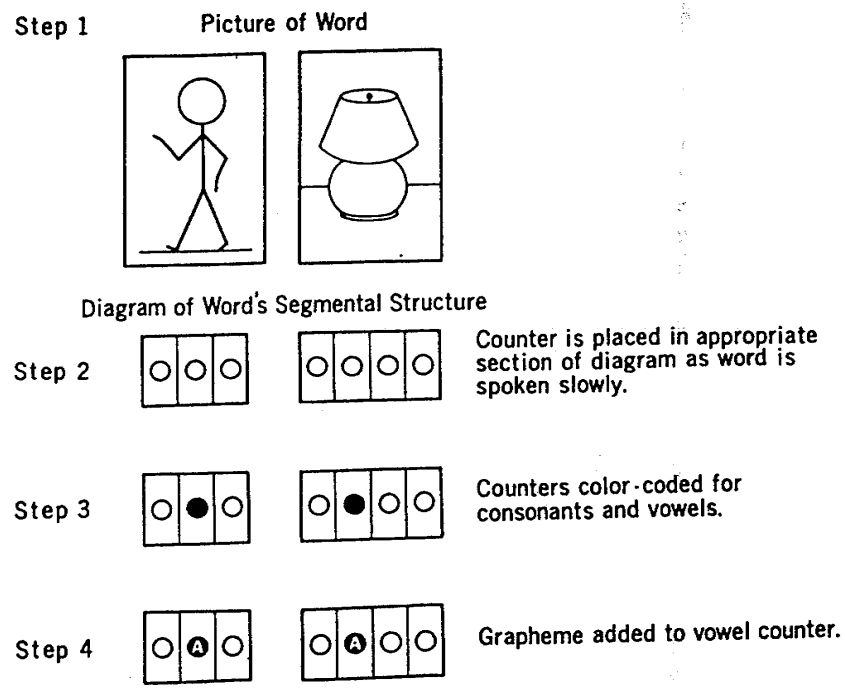

Fig. 1. This diagram is designed to facilitate analysis of the spoken word. Color-coded counters indicate consonant and vowel segments. This illustrates an adaptation of the Elkonin procedure described in the text.

between these when only one vowel is present, the child is asked to put down a pink counter whenever he hears that sound. Not before success has been attained with the five short vowel sounds is the graphic form corresponding to the sound introduced.

The Elkonin procedure has many pedagogic virtues. First, the line drawing keeps the whole word in front of the child throughout the process of analysis, obviating the need to rely on auditory memory to retain the word being studied. Second, the diagram provides a linear visual-spatial structure to which the child can relate the auditory-temporal sequence of the spoken word, thereby reinforcing the key idea of the successive segmentation of the phonemic components of the word. Third, the sections of the diagram call attention to the actual number of segments in the word, so that the child does not need to resort to uninformed guessing. Fourth, the combination of draw-

ing, diagram, and counters provides concrete materials that help to objectify the abstract ideas being presented. Fifth, the procedure affords the child an active part to play thoughout. Finally, the color coding of the counters leads the child to appreciate the difference between vowels and consonants early in his schooling.

The actual content of the Elkonin procedure can, of course, be varied to fit the needs of a particular child or group of children. Thus it can be used not only for kindergarteners but also as a remedial technique for older children. The teacher can, for example, select for analysis syllables that contain the particular phonemes in the particular sequence deemed appropriate.

Three general rules are suggested for the selection of syllables to be segmented. First, for this early training period, the noise portion of a fricative like 's' or the nasal murmur of 'n' or 'm' would be the consonants of choice for the prevocalic position in the syllables to be analyzed. Fricatives and nasals have the advantage that, unlike other consonants (particularly the stops—'b, d, g, p, t, k'), they can be produced in isolation. They can, therefore, be used to acquaint the child with the general idea of word analysis without undue interference from coarticulation.* Second, since two-segment analysis is easier than three-segment,[32] training in segmentation might start with syllables containing two phonemes. Finally, pilot data suggest that VC syllables are easier to analyze than CV, and that both are (as we have said) easier than CVC syllables.[34] Therefore, a progression from VC to CV to CVC, in segmentation training, would probably be most efficacious.

Another approach to training in phonologic analysis is the elision technique outlined by Rosner[33] in his auditory skills program. This approach places a somewhat greater conceptual burden on the child, but could profitably be used in conjunction with the Elkonin procedure. It is always useful to offer a variety of different methods for attaining the same goals, provided that the emphasis in the auditory training is firmly placed on the analysis of the sounds of speech. Training in nonspeech sounds, which are processed quite differently, cannot be expected to have the same effect.[1]

Once the child has been taught, by whatever method, to segment spoken syllables into their phonemic components, the graphic representations of the phonemes can be introduced. The Elkonin technique of adding the letter form to the blank counters might be adopted for teaching the graphic representation of the short vowels and one or two consonants. Thereafter, it would probably be preferable to shift to a more direct procedure for teaching the letters and their phonemic equivalents. This is the stage at which the child progresses from the prereading phase to actual reading instruction.

*Coarticulation refers to the fact that the encoded consonants ('b, d, g, p, t, k', for example) cannot be produced in isolation; they are "coarticulated" with a vowel.

Basic Procedures for Initial Reading Instruction

We believe that the primary emphasis in teaching children to read in an alphabetic system should be on mapping the components of the printed word to those of the spoken word. This analytic conversion from print to speech is best accomplished, in our view, by a method that presents reading, phonics, spelling, and handwriting in coordination with each other so that instruction in each of these skills reinforces and illuminates all the others. The integration of these four aspects of alphabetic communication serves to inform the child that they are different facets of the same process and not separate, unrelated skills.

THE FIRST STEP: LETTER NAMES AND SOUNDS

We would begin reading instruction, as many so-called phonics programs do, by teaching the child to associate the shape of the letter with its name and the sound it makes. We have come to agree with Mathews[44] in his appraisal of this crucial first step:

> No matter how a child is taught to read, he comes sooner or later to the strait gate and the narrow way: he has to learn letters and the sounds for which they stand. There is no evidence whatever that he will ultimately do this better from at first not doing it all. [p. 208]

The simplest and most efficient way of teaching the sound-symbol correspondences is by the direct teaching of paired associates. The child should not be expected to abstract the correspondences for himself by a discovery method. Useful materials for teaching the alphabet are alphabet cards that include not only the upper and lower case form of the letter, but also the mnemonic of a pictured key word beginning with the sound of the letter.[45] On presentation of the card, the child is trained to recite the name of the letter, its key word, and its sound (*a*, 'apple', 'ă'). As the child learns each vowel, its symbol should be listed in a vertical column on the blackboard and reviewed each day. After the child has learned one short vowel in this way, a few consonant symbols are introduced. The remaining vowels and consonants can be taught by the same procedure in tandem with the next step. Meanwhile, the child is taught to write the same letters that he has learned to identify, not an unrelated series of letters presented in a separate writing lesson. These letters can also be incorporated into the step of the Elkonin program in which individual sounds are given graphic representations.

RELATING SPEECH TO PRINT

The next step in most reading programs that emphasize phonics would probably be "sound blending." Since letter-to-sound correspondences have been learned in isolation, the traditional phonics method requires that these be

combined or blended to form words. Here the method runs afoul of the important fact about speech we have emphasized earlier: the spoken word is not a concatenated string of consecutive sounds. In speech, information about the three segments of the word 'cat' is encoded (that is, overlappingly merged) into a single sound, the syllable. Therefore, no matter how fast the consecutive phonemes are spoken, 'kŭh-ă-tŭh' abutted together consecutively will produce only the nonsense trisyllable 'kŭhătŭh' and not the monosyllabic word 'cat'.[1,5]

How can we get around the problem of the fusion of phonemes by coarticulation? Although she also uses the more traditional blending method, Slingerland (Fig. 10-2)[45] describes another technique that solves this problem fairly well. It is a spelling procedure that goes from speech to print, building on skills that have been learned in the prereading program. Instead of demanding that the child perform the impossible task of blending 'hŭh-ă-mm' to produce 'ham', the teacher first says the word 'ham', slowly, emphasizing the medial vowel. The child repeats the word, listens for the vowel sound, selects its letter card (color coded, if still necessary to help the child differentiate vowels from consonants) from a wall pocket-chart, and places it in a lower tier of the pocket-chart. The teacher then repeats the whole word and asks the child for the initial sound in the word. The child then is directed to

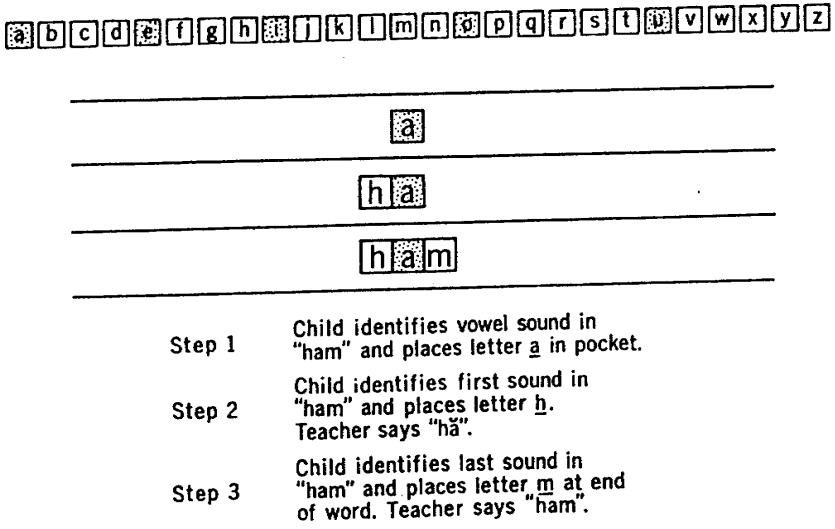

Fig. 2. The manner in which speech is represented by print can be introduced by the procedure illustrated in the diagram. The procedure, which was adapted from Slingerland, is designed to surmount the problem of fusion of phonemes by coarticulation.

pick out the appropriate letter card, identify it, and place it in front of the vowel ("Where does it go? Before the *a*, because it's the *first* sound we hear."). The teacher then draws her finger along the two letters that the child has placed in the lower tier and says: "Now we have made 'hă'. Let's listen to our word again. Our word is 'ham' (drawing out the sounds). What is the *last* sound we hear in 'ham'? That's right, it's 'mm'. Find the letter that makes the 'mm' sound. Where do we put the *m?* At the end of the word, because it's the last sound we hear." The lesson continues with the child reading aloud the whole word that has just been constructed, and ends with the child writing the word either on the blackboard or at the desk, and reading it back after it is written.

Another procedure that should be helpful in relating speech to print comes from Belgrade.[46] The teacher pronounces the sound of the initial consonant (always a nasal or fricative in the early lessons) of a simple CVC word, and writes its letter on the blackboard with a line following it. Drawing out the spoken sound for varying periods of time, the teacher shortens or lengthens the line following the letter ("s----------, s----, s------") as appropriate. This exercise is repeated with the vowel ("ă-------, ă----------, ă----"). Then both sounds are spoken and the interval between them varied and represented accordingly ("s-------, ă----------, s--ă---------, să---"). A consonant in final position is then added ("să-----t") and the word is spoken as a whole ("sat"). Finally, the word is written without the lines and read aloud. In subsequent lessons, the child is taught to read and write other words by the same procedure. After mastering a word, the child writes it in a notebook and perhaps uses it in a written sentence which is then read aloud. In this way, reading, writing, and spelling exercises are always coordinated, as we have also proposed. These and similar procedures[41] make concrete for the child a key fact about writing that is difficult to explain in the abstract: that the temporal succession of the overlapping and nondiscrete speech segments (the phonemes) is represented spatially by a left-to-right linear succession of discrete characters (the letters).

Thus far, the child has learned the letters and their sounds in isolation and has been taught, without using questionable blending methods, the basics of how to convert speech to sequences of letters; that is, the child has learned how to analyze the spoken word and to construct its written model. It remains to teach him how to go from print to speech.

LEARNING THE SYLLABLE TYPES OF ENGLISH

This step is probably the most critical one. It should prepare the child to make the conversion from any printed word to speech, which is what early reading acquisition is all about. A sequence of syllable presentations similar to the Hay-Wingo Ladder[47] devised by two learning disability specialists,

(Nancy Chapel and Cynthia Conway),[48] has been highly successful at this stage of reading instruction (Fig. 10-3). This sequence can be best characterized as a modification of the linguistic method of minimal contrasts, in which the unit under study is the syllable. The goal is to make the conversion from printed syllables to speech more nearly automatic by circumventing the letter-by-letter sound-out and blending of the phonics method. The procedure differs from other syllabic methods in being designed to elucidate for the child the internal construction of the syllable.

In the Chapel-Conway lessons, the short vowels are listed on the blackboard in a vertical column and reviewed, just as they had been during the alphabet drills. This time, however, a dash is added after each letter ('ă_, ĕ_, ĭ_, ŏ_, ŭ_'). The child is taught that the short vowel is always followed by a consonant, and that the dash represents a missing consonant that will be filled in later. He is then taught the game of adding a letter in front of the short vowel and pronouncing the resultant combination ('mă_, mĕ_, mĭ_, mŏ_, mŭ_'). The prevocalic consonant is then varied ('să_, sĕ_, sĭ_, sŏ_, sŭ_'). Meanwhile, the children are encouraged to think of words beginning with those syllables, and are taught to fill in the missing final consonants in those words ('man', 'met', 'mop'). The lessons continue with the addition of consonant blends to the front of the vowel ('smă_, smĕ_, smĭ_').

Step 1 Short Vowel followed by Dash
ă-
ĭ-
ŏ-
ĕ-
ŭ-

Step 2 Addition of Prevocalic Consonant
mă-
mĭ-
mŏ-
mĕ-
mŭ-

Step 3 Construction of CVC Words
mă<u>t</u>
mĭ<u>x</u>
mŏ<u>m</u>
mĕ<u>n</u>
mŭ<u>m</u>

Step 4 Substitution of Prevocalic Consonant
sŏ-
sĭ-
etc.

Step 5 Same as Step 3

Step 6 Substitution of Consonant Blends
smă-
smĭ-
etc.

Step 7 Construction of CCVC(C) Words
smă<u>ck</u>
smĕ<u>ll</u>
etc.

Step 8 Vowel-e
a-e
e-e
i-e
etc.

Step 9 Construction of CVCe Words
ma<u>te</u>
mi<u>te</u>

Fig. 3. The chart shows a step-wise sequence of syllable presentations designed to facilitate automatic conversion from the printed word to speech. It is an adaptation of a procedure designed by Chapel and Conway, as described in the text.

When the short vowel, closed syllable has been mastered, the idea of the long vowel is introduced, again with a structured model (*a-e*). It is pointed out that the missing letter in the model is now followed by an *e*, which is silent but marks the long vowel. Games of word construction with this model are then added. In the last stage, the child learns that when these consonant-vowel combinations appear alone without the added consonant (the dash representing the missing letter is now erased), the vowel is long and matches the letter name, producing an open syllable.

The child now has at his command a number of the major elements needed for decoding phonetically-regular words. The basic contrast between the short and long vowels has been clarified, and the child has been introduced to closed, open, and silent-*e* syllables.

There remain only three phonetically-regular syllable types to be taught: the vowel team (CVVC), vowel = *r* (CV = *r*), and consonant-*le* (C = *le*) syllables. These essentially complete the child's understanding of regular syllable types and provide the basis for analysis of multisyllabic words.

SYLLABIFICATION NOW EASILY TAUGHT

Once the six basic syllable types have been mastered, syllabification is more easily understood. What the child needs to know at this stage can be described by six basic rules. These are (1) divide a compound word between the two words (hot/dog); (2) when the initial vowel is followed by two consonants, divide the word between them (muf/fin, vel/vet); (3) when the initial vowel is followed by one consonant, alternative pronunciations must be matched to words in the child's lexicon (pu/pil, lem/on); (4) when a word ends in *le*, the consonant preceding the *le* begins the last syllable (ta/ble); (5) consonant blends and digraphs are not divided when separating a word into syllables; (6) prefixes and suffixes form separate syllables (re/peat/ing).[49]

IRREGULAR WORDS

Throughout this chapter we have stressed the importance of language analysis skills needed to decode phonetically regular words. Obviously, there are words in English for which such skills are not sufficient. Among them are the small function words that are needed as soon as the child begins to read sentences. Therefore, it is essential that a few of these words be taught early in the child's reading program. Simple flashcard drills seem to be sufficient to teach them to most children; some may need a more intensive approach such as trace/copy/writing-from-memory procedures.[45]

WHICH READING TEXT SERIES TO USE

At this point, something must be said about children's readers. For many children who receive the language analysis skills approach we have outlined, one reading series will probably do about as well as another. However, for the

substantial number of children who have difficulty learning to read, careful control of the linguistic progression in the vocabulary of the reading series is likely to be important for the end result. Therefore, we would recommend that instruction in language analysis skills should be followed by placement in one of the many commercially-prepared linguistic readers in which phonetically regular word patterns are presented systematically. As the skills are introduced in teacher-directed lessons, the linguistic readers will provide the child who needs it with ample opportunity to practice with a reading text composed primarily of phonetically regular words.

It is surely not happenstance that since the pioneering work of Orton,[50] most specialists who have developed remedial procedures for the reading disabled have emphasized a systematic presentation of phonetically regular word patterns.[41, 45, 51-54] However, it should not be necessary to wait until a child has failed before instituting this type of program. Initial reading instruction should emphasize from the beginning that we have an alphabetic, not an ideographic, orthography.

A Postscript on Remediation

Although we have discussed all of the above procedures in terms of regular classroom instruction, these same techniques are the mainstays of remedial programs. Many of the children in need of remedial instruction do not understand the intimate relationship between speech and the orthography. It is of utmost importance that we make this link explicit for them. However, since these children are frequently older and have experienced years of school failure, their needs differ from the six-year-old entering school. Many of the procedures described previously must be adapted to suit the older child. For example, the language analysis activities preliminary to reading instruction can be carried out with words from an age-appropriate vocabulary, colloquial words or nonsense syllables.

Motivating these children for the actual reading task often requires the use of materials relevant to their experiences. An excellent example of this for the older teenager is the use of the Driver's Manual as the core reading text. The phonetically regular and irregular words to be studied can be extracted directly from the manual, their selection determined by needs disclosed in the prior testing. The regular words from the manual can be used to illustrate the basic syllable types, and the others taught as sight words. The language-experience approach, wherein the students compose their own reading material, can be used in an analogous fashion. Additional practice of the phonic generalizations with nonsense syllables ensures that the child can apply the rules to decode new words.

A recently devised remedial program, *The GFB Perceptual Training Drills*,[51] contains several desirable components. Accuracy word lists are used to measure mastery of the six basic syllable types. The suggested sequence enables the student to read multisyllable words early in the program, a highly motivating factor for older students. Once a skill (for example, closed syllables with short 'ă') is mastered, speed drills are intoduced to help bring this skill to an automatic level. Also included is a list of frequently used irregular words, as well as flash cards for teaching sound-symbol relationships. Charts are provided with each component for recording individual progress. This visual representation of progress is especially motivating to the child who has experienced failure in school.

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