In W. Ellis (Ed.), Intimacy with language: A forgotten basic in teacher education. Baltimore: The Orton Dyslexia Society, 1987.

Language and Literacy:
The Obligation of the Schools of Education

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A recent study in the *Reading Research Quarterly* (Stedman and Kaestle 1987) concluded that 20 percent of the adult population, or some 35 million people in our country, have difficulties with simple reading tasks like following directions on a medicine bottle, reading product labels, traffic signs, street names, bus schedules, report cards of their children. I am not surprised to find that 20 percent of our adult population are reading disabled. In our schools today, it is not uncommon to find that some 20 percent of the children in the early grades are labelled learning disabled and the majority of them receive that label because of problems with reading acquisition.

This evening I should like to consider two questions: First, why do so many children and adults have such difficulty in learning to read? And second, what is the obligation of the schools of education in this matter?

WHY LEARNERS HAVE PROBLEMS IN READING ACQUISITION

Broadly speaking, there are two major sets of hypotheses about where the problems of the reading disabled individual might lie. One set may be categorized generally as non-language related. Many hypotheses of that kind have been advanced, but perhaps the most widely held have proposed that children who fail have visual or auditory derangements of some sort.

Since the printed word is conveyed to the reader visually, the possibility of some visual defect, whether central or peripheral, must, of course, be considered. And there are undoubtedly some learners whose problems do stem from that source. Some clinicians and the lay press would have us believe the major problem of the reading disabled is that they actually see letters backwards, upside down, or in a jumble. I have no doubt that such people may indeed exist. However, research on reversal behavior in the reading disabled (Liberman, Shankweiler, Orlando, Bell-Berti, and Harris 1971) shows that most young children who display a great deal of reversal behavior make many errors of other kinds as well—in fact, more errors on vowels and on other than reversible consonants. The authors of controlled studies of reversal behavior have concluded that most disabled readers reverse and transpose letters and words because they have not learned to read and spell properly, not because they cannot see the letters properly. In any case, we know from many exhaustive research reviews over the years (see Benton and Pearl 1978; Rayner 1975; Stanovich 1982; Vellutino 1979), that the difficulties of most of the reading disabled are not attributable to visual defects.

The hypotheses that auditory deficits are critical sources of reading disability has in recent years become more prevalent. However, in my view, it is based on a misunderstanding of the relation between the auditory and language systems— in fact, on a false assumption, namely, that the terms auditory and linguistic are interchangeable. I will have more to say about that later.

Research for the past 20 years has persuaded me and my colleagues that most problems in learning to read and write stem from deficits in language-related skills, not from problems in the visual or auditory systems, and an increasing number of other investigators have come to agree.

But language has many facets— phonology, syntax, semantics, pragmatics. If we were to provide direction for the prevention and remediation of reading disabilities, we needed to pinpoint more specifically where in language the difficulties are to be found. Early in our research (Liberman 1971, 1973) we guessed that many, perhaps most, of the difficulties are in the phonological domain, and so we put our attention there. Because an alphabetic orthography represents the phonology, however approximately, that seemed a plausible guess and, therefore, the right place to start. The results of research have, I think, justified our assumption, providing evidence that deficits of phonological processing do, indeed, underlie many of the difficulties that poor readers and spellers have.

My first aim today will be to describe those difficulties and some of the evidence. This part of my talk will be divided into three sections, The first and most comprehensive section will deal with phonology and the word in print; the second with phonology as it relates to speech perception and production; the third with phonology and the successful deaf reader. In the second part of my paper, I will look into what our schools of education are doing to prepare our future teachers to deal with reading.

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PHONOLOGY AND THE WORD IN PRINT

Before we talk about phonology and the word in print, I should probably differentiate phonology from phonics. Phonics, as you all know, commonly refers to an instructional approach that introduces beginning and disabled readers to the word in print by acquainting them with what are called letter-sound correspondences and how these letter-sound correspondences form words. The phonics method (or, more properly, methods, since many different procedures would qualify for that designation) is, in effect, one way to help the child to see that words have an internal phonological structure. The phonology, on the other hand, is an inborn system that all members of the human race use for producing an indefinitely large number of words out of a few dozen, abstract, meaningless elements. These elements are normally conveyed by sound, but are not themselves sounds, as I will try to make clear in a moment.

Phonology and Language

To see what phonology has to do with reading the word in print, we must first, I think, remind ourselves about what phonology has to do with language. Perhaps the best way to do that is to imagine what language would be like if there were no phonology. In that case, each word in the language would have to be represented by a separate signal— for example, a sound— that differed holistically from the signals for all other words. The obvious consequence would be that the number of words could be no larger than the number of holistically different signals a person can efficiently produce and perceive. Of course, we don't know precisely what that number is, but surely it must be small, especially in the case of speech, by comparison with the hundreds of thousands of words that a language commonly comprises.

What a phonology does for us, then, is to provide the basis for constructing a large and ever expandable set of words— all the words that ever were, are, or will be— and to construct them, moreover, out of only two or three dozen abstract signal elements. These abstract signal elements, the phonemes, are not themselves sounds, but are represented— though only after complex transformations— by the sounds of speech.

All this is to say that phonology is real— it was not invented by linguists— and, more important, that whatever else words may be, they are always phonological structures. I take it as given, therefore, that in understanding language, whether it is written or spoken, one does not normally get to the meaning directly, that is, one does not normally by-pass the phonology. Instead, both the listener and the reader get to the meaning via the phonology. The meaning of a word, or its grammatical status, may be ambiguous, unknown, or subject to dispute, but the word is always a string of abstract phonological elements, and, within quite narrow limits, all speakers of the language can agree about the form of that string of elements.

It follows, then, that if we have perceived or produced a word, whether in speech or in reading, we have in fact engaged a phonological structure. If we have misperceived a word or misproduced a word, we have in fact engaged the wrong phonological structure. I take all that as given by the very nature of language, that is, language as distinguished from other forms of communication like, for example, pictures or automobile horns.

But why, then, should reading words be difficult in a alphabetic orthography, considering that the alphabetic transcription represents, even if only approximately, the phonological structure that the reader must grasp?

Phonology and Listening to Speech. To understand the problem one faces when required to read a word, we must consider, if only briefly, how the word is perceived when it is spoken. As I've said, the word is formed by a phonological structure, so when the word is perceived it is that structure that is accessed. But the speaker of the word did not produce the phonological units one at a time, each in its turn— that is to say, the speaker did not spell the word out loud. Instead, in producing the syllable "ba," for example, the speaker assigned the consonant we know as "B" to the lips, and the vowel we know as "A" to a shaping of the tongue, and then produced the two elements at pretty much the same time.

The advantageous result of such coarticulation of speech sounds is that speech proceeds at a satisfactory pace— at a pace indeed at which it can be understood (Liberman, Cooper, Shankweiler, and Studdert-Kennedy 1967). Can you imagine trying to understand speech if it were spelled out to you letter by painful letter? So coarticulation is certainly advantageous for the perception of speech. But a further result of coarticulation, and a much less advantageous one for the would-be reader, is that there is, inevitably, no neat correspondence between the underlying phonological structure and the sound that comes to the ears. Thus, though the word "bag" has three phonological units, and, correspondingly, three letters in print, it has only one pulse of sound: the three elements of the underlying phonological structure— the three phonemes— have been thoroughly overlapped and merged into that one sound—"bag."

A Difference between Listening and Reading. Reading is different from listening in that it is, in some significant ways, a secondary, obviously less natural, use of language— part discovery, part invention. It follows, then, that even though its processes must make contact with those of the natural and primary language system, special skills will be required if the proper contact is to be made. The point of that contact is the word, which is, of course, represented in the print by a transcription of the phonological structure. But that transcription will make sense to the learner only if he or she understands that the transcription has the same number and sequence of units as the spoken word. Only then will the relation between the print and the word be apparent.

In other words, readers can understand, and properly take advantage of the fact that the printed word *bag* has three letters, only if they are aware that the spoken word "bag," with which they are already quite familiar, is divisible into three segments. They will probably not know that spontaneously, because, as I've said, the relevant processes of speech perception, which they already command, are automatic and quite unconscious. Moreover, it may be somewhat difficult to teach them what they need to know because, given the overlap of phonological information, the merging by coarticulation, that characterizes the spoken word, there is no way to produce many of the consonant segments in isolation. The teacher can try, as is commonly done in the phonics method of instruction, to "sound out" our word "bag," but in so doing will necessarily produce a nonsense word comprising three syllables— "buh-ae-guh." Such instruction, in my view, is vastly preferable to a currently popular procedure, dubbed by its creators the psycholinguistic guessing game (Goodman 1976). In this widely used procedure, the student is encouraged to ignore the phonological structure of the words and to reach the meaning of the printed message by guessing from a few known words and the context. But even with the much preferable phonics method of instruction, it can be hard to get some children to become aware of the underlying phonological structure of the spoken word—and, accordingly, why it makes sense to represent the monosyllable "bag" with three letters. There is much evidence now that many novice readers do indeed find it hard to see why and further that their difficulty is related to poor reading ability.

Awareness of Phonological Structure

Some 15 years ago we began to examine developmental trends in phonological awareness by testing the ability of young children to segment words into their constituent elements (Liberman, Shankweiler, Fischer, and Carter 1974). We found that normal preschool children performed rather poorly. We learned further that of the two types of sublexical units— the syllables and the phonemes— the phoneme, which happens to be the unit of our alphabetic writing system, presented the greater difficulty by far. None of our four-year-olds could accurately count the number of phonemes in familiar monosyllabic words, though about half managed an accurate count of syllables in multisyllabic words. At the age of five, a similar pattern emerged— almost half succeeded in the syllable task but less than a fifth could do the phoneme task. At the end of the first school year, ten percent were still failing the syllable counting task, but 30 percent were unable to perform phoneme counting.

It was clear from these results that awareness of phoneme segments, the basic units of the alphabetic orthography, is initially harder to achieve than awareness of syllable segments and develops later, if at all. More relevant to our present purposes, it was also apparent that a large number of children may not have attained either level of understanding of linguistic structure, syllable or phoneme, even at the end of a full year in school. They are the ones we need to worry about, I believe, because they are the ones who are deficient in the linguistic awareness that provides entry into the alphabetic system. There is much evidence now that awareness of linguistic structure— an awareness that so many young children lack— may be important for the acquisition of reading and spelling.

Awareness of Phonological Structure and Literacy

Much evidence is now available to suggest that awareness of the phonological structure of the phonological constituents of words— or as it is sometimes called, metalinguistic awareness— is most germane to the acquisition of alphabetic literacy. This evidence comes from studies, many of which have been carried out in languages other than English, which have shown that this awareness is predictive of reading success in young children. In English, there are, to mention a few besides our own (Liberman 1973; Mann and Liberman 1984), studies by Blachman (1983); Bradley and Bryant (1983); Fox and Routh (1980); Goldstein (1976); Helfgott (1976); Treiman and Baron (1981); Zifcak (1977). Their findings have been supported by studies in Swedish by Lundberg and associates (1980) and by Magnusson and Naucler (1987), in Spanish by de Manrique and Gramigna (1984), in French by Bertelson's laboratory in Belgium (Alegria, Pignot, and Morais 1982), and recently in Italian by Cossu and associates (Cossu, Shankweiler, Liberman, Tola and Katz, in press).

One foreign study worthy of special mention because it examined so many different abilities, both linguistic and nonlinguistic, was carried out in Sweden by Lundberg and his associates (1980). They found that phonological awareness, or the ability to segment words into phonemes, was the single most powerful predictor of future reading and spelling skills in a group of children tested at the end of their kindergarten year.

Effect of Training in Awareness

There is now some evidence that phonological awareness is not only predictive of future literacy but may actually help the novice to learn to read and write. This evidence comes from a pair of experiments by Bradley and Bryant (1983). The first looked at the performance of a large number of four-and five-year-olds, none of whom could read, on a metalinguistic task requiring them to categorize words according to their phonological constituents, that is, to sort words by whether they rhyme or not. As in previous studies, high correlations were found between phonological awareness, in this case measured by the rhyme categorization scores, and the children's reading and spelling scores three years later.

However, as the authors themselves correctly point out, simply to show that children's skills in metalinguistic awareness are predictive of their success or failure in reading later on does not by itself prove that the relation-

ship is necessarily a causal one. In order to get around this problem, they carried out a second experiment. This was a training study, using subsamples of the original group, all with initially low scores on phonological judgments. For one subgroup, the training was phonological; it directed the child's attention to shared initial, medial, and final phonemes in pairs of consonant-vowel-consonant words. A second group was taught the same information, but in addition was shown how phonemes in the test words could be represented by letters of the alphabet. A third group received instruction in semantic classification of the same set of words, sorting by meaning, rather than by phonological structure of the words. As an additional control, a fourth group received no special training at all. It was found at the end of the project that the children receiving training in phonological categorization were superior to the semantically trained group on standardized tests of reading and spelling, and those trained with alphabet letters in addition to the phonological training were even more successful (particularly in spelling).

At the very least, these two experiments— combining longitudinal and training components— do two things: they support other studies showing that phonological awareness can be trained in young children (see Content, Morais, Alegria, and Bertelson 1982; Olofsson and Lundberg 1983; Vellutino 1985). Beyond that, moreover, they also indicate that this training can have beneficial effects on children's future progress in learning to read and spell.

Phonological Awareness and Adult Literacy

What about phonological awareness in adult nonreaders? Is it still a problem for them? The question as to whether phonological awareness improves spontaneously with age or requires some form of instruction is a crucial one, with obvious implications not only for preschool instruction but also for the design of literacy teaching programs geared to adolescents and adults. This question was explored in an unusual investigation by a Belgian research group who examined the phonological awareness of illiterate adults in a rural area of Portugal (Morais, Cary, Alegria, and Bertelson 1979). They found that the illiterate adults could neither delete nor add phonemes at the beginning of nonsense words, whereas others from the same community who had received reading instruction in an adult literacy class succeeded in performing those tasks. The authors conclude that awareness of phoneme segmentation does not develop spontaneously even by adulthood but arises as a concomitant of reading instuction and experience.

In view of these findings with adults, we believed it would prove of value to explore further the cognitive characteristics of adult poor readers. We have approached the problem in two ways: first, we have made arrangements to replicate the Portuguese study in Yugoslavia with Serbo-Croatian subjects. That study commenced in the summer of 1987. And second, members of our reading research group (Liberman, Rubin, Duques, and Carlisle 1985) have conducted a pilot study of a community literacy class. We consider the study only a very moderate step toward our goal, but one that nonetheless provides some promising leads.

The relevant tasks that we administered included reading and dictated spelling of real words and nonwords. In addition, a test of phoneme analysis was also included. In a comparison of the reading and spelling of our adult subjects, we found, as would be expected, that their reading of single real words was better than their spelling of such words. But on nonwords, where some explicit reference to the phonological structure is obligatory rather than optional as it may be with real words, their performance was quite different. Their performance on both reading and spelling was very poor for the nonwords, and virtually identical in quality, suggesting a serious deficiency in the ability to deal with phonological structure in the absence of semantic support.

The performance of these adult poor readers in the task directly measuring language analysis at the phonemic level provides additional support for the hypothesis that they may have a deficiency in phonological awareness. The task was a very simple one— the subjects were only required to identify the initial, medial, or final sound in monosyllabic words. Though this is an exercise that one might expect a first grader to be able to perform, our adults managed to produce correct responses on only 58 percent of the items. Moreover, they clearly found it to be singularly frustrating and unpleasant. This inability of adults with literacy problems to perform well on tasks demanding explicit understanding of phonological structure has also been found by other investigators— Byrne and Ledez (1983) in Australia; Mercel (1980) in England; and Read and Ruyter (1985) in a prison population in the U.S.

Question of a General Analytic Deficiency

Despite much evidence of the kind we have outlined thus far, there remained a question as to whether the deficiency was in fact necessarily phonological, or even linguistic, or whether it might instead be attributable to a deficiency in general analytic ability (Wolford and Fowler 1983). That question is addressed directly and, in our view, very convincingly, in two recent studies. One was by the Belgian group of experimenters (Morais, Cluytens, and Alegria 1984). They showed that poor readers— in this case, children aged six to nine with severe reading disability— were poorer than normal readers in segmenting words into their constituent parts, but performed just as well as normal readers in a similar task that required them to deal analytically not with words, but with musical tone sequences.

The question of a possible general analytic deficit was recently addressed very convincingly in a study by Pratt at the University of Rhode Island (Pratt 1985). She carried out two complementary experiments, one with good and

poor readers in adult education classes and the other with good and poor readers in the third grade. Both reader groups were given three linguistic awareness tests and one nonspeech control test identical in format to one of the linguistic measures. Significant differences were found between the good and poor readers at both age levels on all three linguistic awareness measures, but not on the nonspeech control test. So the poor readers, whether young or old, had no more difficulty in segmental analysis than the good readers when the task was nonlinguistic; their problem was limited to the segmental analysis of speech.

From these two studies it seems fair to suppose that the deficiency the poor readers were exhibiting was not due to some general analytic disability, but was instead, specifically language-related, and, more than that, specifically phonological in nature.

As we have seen, then, there is now a wealth of evidence pointing to metalinguistic deficiencies in the phonological domain in people of various ages, language communities, and cultural backgrounds, who have difficulty in attaining literacy. We would suggest that perhaps it would be reasonable now to consider seriously the possibility that the deficiency in these individuals who are resistant to ordinary methods of literacy instruction may not be limited to awareness of the phonology but may reflect instead a more general deficiency in the phonological domain itself. Let us consider briefly a bit of the evidence for that conjecture.

PHONOLOGY AND SPEECH PERCEPTION/ PRODUCTION IN POOR READERS

Recent research hints that reading disabled children may have a subtle deficit in the perception of auditorily presented material, but that this deficit is specific to phonological perception, and not a deficit in auditory perception generally. Consider some recent findings reported by Brady and associates (Brady, Shankweiler, and Mann [1983]) at Haskins Laboratories (and recently replicated in part by Naucler and Magnusson [1987] in Sweden). They carried out an experiment in which good and poor readers were tested on two auditory perception tasks, one involving words and the other nonspeech environmental sounds. The identification tasks were presented under two conditions— with favorable and unfavorable noise ratios. The finding were that the poor readers did show a deficit, but it was specific to the speech stimuli and occurred only in the noise-masked condition. They did not differ from the good readers in the perception of nonspeech environmental sounds, whether the sounds were noise-masked or not.

Note that the poor readers apparently needed a higher quality of signal than the good readers for error-free performance in speech, but not for nonspeech environmental sounds. These results suggest that poor readers' perceptual deficit may be related not to auditory perception in general, as is often thought, but rather to the apprehension of the phonological structure of words.

Support for the notion that poor readers may have underlying deficits in phonological processing comes also from a study of the speech production errors of junior high students reported recently in the *Journal of Learning Disabilties* (Catts 1987). In this study, the reading disabled students made significantly more errors than matched normals on three different tasks in which their speech production was stressed: in naming of pictured objects with difficult names; in repetition of multisyllabic words with complex phonetic sequences; and in repetition of phrases with confusing phonetic sequences. It was concluded that the error patterns of these students strongly suggested that their difficulties in speech production may be an extension of deficits in phonological processing.

PHONOLOGY AND THE DEAF READER

As noted earlier, the phonological structure of language is conveyed to us after certain complex transformations by the sounds of speech. Given that phonological awareness can be difficult for the would-be reader who can hear, we would expect that the learner who has difficulty hearing the sounds of speech would be even more affected. And indeed we find that the reading of the average hearing-impaired high school graduate tests at about the fifth grade level, and the profoundly deaf high school graduate reads on the average at about the third grade level.

But there are some congenitally, profoundly deaf individuals who can read well, even up to the college level. What about them? Recently, Vicki Hanson and her associates at Haskins asked that question in a series of experiments (Hanson 1982; Hanson and Fowler 1987). What they found was that the successful deaf readers were not limited to reading English as if it were a logographic orthography; they were not, as might be supposed, dependent on a store of visual patterns and associated words learned by rote memory. Instead, despite profound hearing loss since birth, they were able to use abstract phonological information both in reading and in short term memory, much as the successful hearing reader does. In reading, for example, they demonstrated phonological sensitivity by responding differentially to rhyming and nonrhyming pairs of words (save/wave vs. have/ cave) and by being able to identify the real word equivalents of nonwords ("flame" for *flaim*; "tall" for *taul*).

In the short term memory experiment, three sets of words were randomly interleaved: phonologically similar (rhyming) words, orthographically similar words, and words whose signs were formationally similar. A relative decrement in memory for a particular set would suggest the type of representation being used to hold the information in memory. Difficulties with memory for phonologically similar sets would suggest that the subjects were using a phonetic memory code; difficulties with the visually similar sets would point to a visual code, difficulties

with the formationally similar lists, a sign code. Like their hearing peers, the successful deaf readers showed difficulties with the phonetically confusing sets and no particular problem with the visually confusable or formationally confusable ones. Thus it appears that the good deaf readers were using phonological representations to hold information in memory.

I am not surprised to find that the successful deaf readers use phonological processing in reading and in short term memory. As I have said earlier, I take it as given that in understanding language, whether it is written or spoken, one gets to the meaning by dealing in distinctively linguistic ways with the units of the language, for example, with the phonologically represented words and with the larger syntactic structures they form.

THE LANGUAGE MODE AND READING

In order to comprehend language, both the reader and the listener must carry out some kind of linguistic processing, however automatic it may be. The reader is not going to get to the meaning directly from the optical forms of the orthography any more than the listener can get to the meaning directly from the auditory patterns of the acoustic signal. The processes by which we extract meaning from language are different in important ways from those by which we extract meaning from other visual stimuli like pictures or from auditory stimuli like automobile horns or cowbells. What needs to be made clear is that words are distinguished from all other meaningful signals by the fact that all words, and only words, have phonological structure and, moreover, that the phonological units that form the structure of words are neither visual nor auditory. Instead, they are to varying degrees abstractly linguistic.

Whether language comes in through the ear or through the eye, it is necessarily transformed into a different mode, one that relates to the structures of language. Thus the perception speech is only peripherally auditory; it involves, in addition, specific processes in the language mode, both phonologic and syntactic, that are different from the perception of nonspeech sounds (A. M. Liberman and Mattingly 1985; Liberman and Studdert-Kenndy 1977).

As for reading of print, that is also only peripherally sensory. Printed words are, of course, in the first instance apprehended visually. But the letters of the orthography are not simply optical displays to be apprehended visually like the shapes in a Mondrian painting. They represent the units of the language and have been developed to fit its phonology. It is clear that the letter patterns are not totally arbitrary with respect to the language. For example, the letter patterns never represent a phoneme and a half, or a syllable and a quarter, or a word and a third. Instead, they represent phonemes, syllables, and words. And because they do, normal readers can make contact with those structures of the phonology and syntax that already exists in their heads and are perfectly natural to all human beings. Normal readers can thus invoke their normal and natural language processes to apprehend the message that the orthography conveys. And conversely, a would-be reader with deficits in such language processing abilities might well have difficulties.

When I say even the skilled reader must go through the phonology in order to get to the message, I do not mean that skilled readers, like many struggling beginners, sound out the words letter by letter. As we have said elswhere (I.Y. Liberman, Shankweiler, A.M. Liberman, Fowler, and Fischer 1977; I.Y. Liberman, A.M. Liberman, Mattingly, and Shankweiler 1980), neither the beginner nor any other reader can recover the words from print on a letter-by-letter basis. Every reader must group the letters so as to put together just those strings of consonants and vowels that are, in the normal process of speech production, collapsed into a single, pronounceable unit. There is no simple rule by which a reader can do this. The pronounceable unit may comprise almost any number of letters from one to nine, or at the level of prosody, even more. We suspect that acquiring the ability to do this, that is, knowing how to combine the letters of a new word into the appropriate pronounceable units efficiently and automatically, is an aspect of reading skill that, as much as any other, separates the fluent reader from the beginner who has barely discovered what an alphabetic orthography is all about.

For the beginning reader with adequate phonological awareness, this advanced level of efficiency and automaticity will develop through a brief spell of direct instruction in decoding, followed by practice with interesting materials, and the futher enhancement of vocabulary and knowledge that comes with this and other experience. For beginning readers with varying degrees of deficits in phonological awareness, who may include as many as 20-25 percent of the regular class population, varying amounts of more direct training in the relation between print and speech will be needed. There are many procedures for doing this and later speakers in this conference will have much to say about how this might be done and with what succcess.

In the time remaining to me, I should now like to turn to the second question that I posed at the outset— the obligation of the schools of education for the high levels of illiteracy in our schools.

THE OBLIGATION OF THE SCHOOLS OF EDUCATION

I hope you will agree with me, certainly by the end of this conference, that there is a wealth of information from laboratories around the globe that could be put to use in preventing reading disabilities in many children and in remediating the problems of many others. What I have found in my many visits to schools in this country and abroad is that critical information about reading acquisition and its disabilites is all too frequently not trickling

down to the teachers. And that is particularly the case in areas where, as in this country, the training of teachers is in the control of self-perpetuating professional educators in schools of education. Much of the criticism currently being levelled at teachers is, in my opinion, unfair. It is unfair because so often the criticism should have been directed not against them but against the certification policies and the training procedures of the professional teacher-trainers.

The certification policies seem to me to have been motivated more by a need to maintain the status quo of the schools of education than to provide us with competent teachers. In a profession that should be fostering excellence, we have seen instead policies that have often turned away many of our most able college students. These policies have included a proliferation of course requirements that must be met even by the liberal arts graduate. Many of these courses may seem appropriate from their catalogue descriptions but in practice turn out to be of such low level content that our most able college students find them at the best insulting and at the worst unbearable. But without these courses on their transcripts, would-be teachers cannot find employment in our public schools. I would venture a guess that many of our speakers today would be ineligible to teach in our public schools on this account.

These are of course concerns about general educational practices. Much more could be said about them, but this is not the proper forum for that. What about teacher training that is more specific to reading? When one considers the central importance of reading skill in the overall educational experience, it is truly astonishing to find how little actual training in reading instruction is provided in many of our teacher-training institutions. Even for the teacher who is being trained to teach in the primary grades, reading instruction is often squeezed into a single, omnibus so-called methods course along with math, science, social studies, health education, and, lately I expect, morals and sex education as well.

Having observed the kind of information that is being imparted in that brief exposure to reading methods, I have begun to think that it may be just as well that more time is not allotted for reading instruction in our teacher-training institutions. Most definitions of dyslexia, as you know, describe dyslexics as being resistant to ordinary methods of instruction. In my view, those so-called ordinary methods of instruction as currently presented in our schools of education need to be critically examined. Many teachers of beginning reading are being trained to teach reading in an alphabetic orthography without ever being taught how an alphabetic orthography represents the language, why it is important for beginning readers to understand how the internal structure of words relates to the orthography, or why it may be hard for children to understand this. Though its relevance has been confirmed over and over again, many prospective teachers are not being taught the critical role phonological awareness can play in the child's mastery of the alphabetic principle, or how to identify a child who is deficient in such awareness and what can be done about it.

In fact, our student teachers are all too often being currently provided with an instructional procedure that directs them specifically not to trouble the child with details of how the orthography works. Phonological information, if taught at all, is relegated to a time period separate from reading proper and totally unintegrated with it. In a misguided attempt to produce immediately what is called reading for meaning, the teacher trainers all too often provide the prospective teacher with an instructional procedure that encourages children to memorize the appearence of words as wholes by whatever means they can muster and to guess the rest of the message from picture cues and context. The teachers are told not to bother the children with the phonological structure, it will only get in the way: if the children read "crest " for toothpaste, they are not to be corrected—Crest is a toothpaste, after all (see Goodman and Goodman 1979). An exercise that has been suggested to promote early reading acquisition is to splash some ink onto the page of the print and to let the child guess what might be said under the ink (Giordano 1980). A visual method of teaching spelling that is currently in vogue in our schools of education presents the pupil with a list of spelling words to be matched by contour with visual shapes in an adjoining column. Methods such as these would surely not be likely to lead a learner to understand what reading and spelling in an alphabetic system are all about.

Fortunately, many children— the lucky 75 percent or so who do learn to read whatever the method— pick up the alphabetic principle on their own. That is, they simply begin to discover for themselves the commonalities between similarly spoken and written words. These children when tested in kindergarten turn out to be the ones with strength in phonological awareness. Unfortunately, for the many children with initial weakness in phonological awareness, that is who do not understand that the spoken word has segments, and who have not discovered on their own that there is a correspondence between those segments and the segments of the printed word, the whole word, psycholinguistic guessing game approach and the nonlinguistic visual methods are likely to be disastrous.

The many children with weakness in phonological awareness may never discover on their own how the alphabet works and will simply join the ranks of the millions of functional illiterates that we spoke about at the outset. They will stumble along guessing at the message with their little store of memorized words, unable to decipher a new word they have never seen before. (An example would be the man in an adult education class who could recognize the multisyllablic word, *photograph*, that he had memorized, but who had no idea how to decipher the three-letter word, *peg*, that he had not previously encountered) Some of these individuals with deficient phonological awarness, if they are lucky, may eventually be led to discover what they need to know through individual-

ized instruction with a special education teacher. But they will meanwhile have lost precious time for the practice that is essential in the mastery of any skill, and will probably have to play catch-up all through the remainder of their school experience.

RECOMMENDATIONS FOR TEACHER TRAINING

In my view, children should not be required to fail before they are taught what they need to know. Why not introduce them to the alphabetic principle at the outset of instruction in reading? Indeed, since so many beginners appear not to get the idea on their own, why not teach the alphabetic principle directly to all the children from the start of their school experience? Those who get the message quickly can simply go forward with their reading program, but those who do not can receive the help they need. The reasons usually given for not proceeding in this sensible manner are that teaching phonological structure makes reading a dull, off-putting chore instead of the source of pleasure and enjoyment that it should be and, moreover, that it gets in the way of reading for meaning.

How to answer these charges? Well, first of all, the teaching of structure need not be dull and off-putting; a creative teacher can actually make it so rewardingly productive and such fun that other children beg to be allowed to participate (Liberman and Shankweiler 1979; Liberman, Shankweiler, Camp, Blachman, and Werfelman 1980).

Second, if reading for meaning is the goal, as we all agree it should be, then teachers must understand that we cannot reach the meaning of a word until we have apprehended the word itself, and that the word is something apart from its meanings. Before one can get to the meaning (or to one of the several possible meanings) of a word represented by the print, one must first get from the print to the phonological structure. Until learners can do this they cannot take full advantage of the alphabetic system, that is, cannot read new words they have never seen before.

In the light of all the research supporting the importance of phonological factors in successful reading acquisition, we should question the use of instructional procedures like the Language Experience and Whole Word Methods that seek to by-pass phonological instruction. At the very least, we should insist that prospective teachers understand the need to provide for individual differences in the linguistic abilities required for reading proficiency in an alphabetic writing system (Liberman 1983). Moreover, if phonological instruction has not been an integral part of the reading method used to teach the children, we should be especially wary of explanations that attribute the children's reading failures to nonlanguage factors, like differences in the sensory (visual or auditory) learning style of the children (Liberman 1985) or the motivational or cultural shortcomings of their families (Blachman, this volume and Read and Ruyter 1985 for relevant research).

References

Alegria, J., Pignot, E., and Morais, J. 1982. Phonetic analysis of speech and memory codes in beginning readers. *Memory and Cognition* 10:451-456.

Benton, A. L., and Pearl, D. 1978. *Dyslexia: An appraisal of current knowledge*. New York: Oxford.

Blachman, B. 1983. Are we assessing the linguistic factors critical in early reading? *Annals of Dyslexia* 33:91-109.

Bradley, L., and Bryant, P. E. 1983. Categorizing sounds and learning to read— a causal connection. *Nature* 301:419-421.

Brady, S. A., Shankweiler, D., and Mann, V. A. 1983. Speech perception and memory coding in relation to reading ability. *Journal of Experimental Child Psychology* 35:345-367.

Byrne, B., and Ledez, J. 1983. Phonological awareness in reading-disabled adults. *Australian Journal of Psychology* 35:185-197.

Catts, H.W. 1986. Speech production/phonological deficits in reading disorders children. *Journal of Learning Disabilities* 19(8):504-508.

Content, A., Morais, J., Alegria, J., and Bertelson, P. 1982. Accelerating the development of phonetic segmentation skills in kindergarteners. *Cahiers de Psychologie Cognitive* 2:259-269.

Cossu, G., Shankweiler, D., Liberman, I.Y., Tola, G., and Katz, L. (in press). Awareness of phonological segments and reading ability in Italian children. *Applied Psycholinguistics*.

Fox, B., and Routh, D.K. 1980. Phonetic analysis and severe reading disability in children. *Journal of Psycholinguistic Research* 9:115-119.

Giordano, G. 1973. Three criteria for judging initial reading instruction. *Academic Therapy Quarterly*. 8:447-483.

Goldstein, D. M. 1976. Cognitive-linguistic functioning and learning to read in preschoolers. *Journal of Experimental Psychology* 68:680-688.

Goodman, K. S. 1976. Reading: A psycholinguistic guessing game. *In* H. Singer and R. B. Ruddell (eds.). *Theoretical Models and Processes of Reading*. Newark, DE: International Reading Assn.

Goodman, K. S., and Goodman, Y. 1979. Learning to read is natural. *In* L. Resnick and P. Weaver (eds.). *Theory and Practice of Early Reading*. Hillsdale, NJ: Erlbaum.

Hanson, V. L. 1982. Short-term recall by deaf signers of American Sign Language: Implications of encoding strategy for order recall. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 8:572-583.

Hanson, V.L., and Fowler, C.A. 1987. Phonological coding in word reading: Evidence from hearing and deaf readers. *Memory and Cognition* 15(3):199-207.

Helfgott, J. 1976. Phoneme segmentation and blending skills of kindergarten children: Implications for beginning reading acquisition. *Contemporary Educational Psychology* 1:157-169.

Liberman, A. M., Cooper, F. S., Shankweiler, D. P., and Studdert-Kennedy, M. 1967. Perception of the speech code. *Psychological Review* 74:43-461.

Liberman, A. M., and Mattingly, I. G. 1985. The motor theory of speech perception revised. *Cognition* 21:1-36.

Liberman, A. M., and Studdert-Kennedy, M. 1977. Phonetic perception. *In* R. Held, H. Leibowitz, and H.L. Teuber (eds.). *Handbook of Sensory Physiology*, Vol. VIII, "Perception". Heidelberg: Springer-Verlag, Inc.

Liberman, I. Y. 1971. Basic research in speech and lateralization of language: Some implications for reading disability. *Bulletin of the Orton Society* 21:71-87.

Liberman, I. Y. 1973. Segmentation of the spoken word and reading acquisition. *Bulletin of the Orton Society* 23:65-77.

Liberman, I. Y. 1983. A language-oriented view of reading and its disabilities. *In* H. Myklebust (ed.). *Progress in Learning Disabilities*. New York: Grune and Stratton.

Liberman, I.Y. 1985. Should so-called modality preferences determine the nature of instruction for children with learning disabilities? *In* F.H. Duffy and N. Geschwind (eds.). *Dyslexia: A neuroscientific approach to clinical evaluation*. Boston: Little, Brown.

Liberman, I. Y., Liberman, A. M., Mattingly, I. G., and Shankweiler, D. 1980. Orthography and the beginning reader. *In* J. F. Kavanagh and R. L. Venezky (eds.). *Orthography, reading, and dyslexia*. Baltimore, MD: University Park Press.

Liberman, I. Y., Rubin, H., Duques, S., and Carlisle, J. 1985. Linguistic abilities and spelling proficiency in kindergarteners and adult poor spellers. *In* J. Kavanagh and D. Gray (eds.). *Biobehavioral Measures of Dyslexia*. Parkton, MD: York Press, Inc.

Liberman, I. Y., and Shankweiler, D. 1979. Speech, the alphabet and teaching to read. *In* L. B. Resnik and P. A. Weaver (eds.). *Theory and Practice of Early Reading*. Hillsdale, NJ: Erlbaum.

Liberman, I.Y., and Shankweiler, D. 1985. Phonology and the problems of learning to read and write. *Remedial and Special Education* 6:8-17.

Liberman, I. Y., Shankweiler, D., Camp, L., Blachman, B., and Werfelman, M. 1980. Steps toward literacy. *In* P. Levinson and C. Sloan (eds.). *Auditory Processing and Language: Clinical and research perspectives*. New York: Grune and Stratton.

Liberman, I. Y., Shankweiler, D., Fischer, F.W., and Carter, B. 1974. Explicit syllable and phoneme segmentation in the young child. *Journal of Experimental Child Psychology* 18:201-212.

Liberman, I. Y., Shankweiler, D., Orlando, C., Harris, K. S., and Bell-Berti, F. 1971. Letter confusions and reversals of sequence in the beginning reader: Implications for Orton's theory of developmental dyslexia. *Cortex* 7:127-142.

Lundberg, L., Olofsson, A., and Wall, S. 1980. Reading and spelling skills in the first school years, predicted from phonemic awareness skills in kindergarten. *Scandinavian Journal of Psychology* 21:159-173.

Magnusson, E. , and Naucler, K. 1987. Language disordered and normally speaking children's development of spoken and written language: Preliminary results from a longitudinal study. *Reports from Uppsala University., Linguistics Department* 16:35-63.

Mann, V. A., and Liberman, I. Y. 1984. Phonological awareness and verbal short-term memory: Can they presage early reading problems? *Journal of Learning Disabilities* 17:592-599.

deManrique, A.M.B., and Gramigna, S. 1984. La segmentacion fonologica y silabica en ninos de preescolar y primer grado. *Lectura y Vida* 5:4-13.

Marcel, A. 1980. Phonological awareness and phonological representation: Investigation of a specific spelling problem. *In* U. Frith (ed.). *Cognitive Processes in Spelling*. London: Academic Press.

Morais, J., Cary, L., Alegria, J., and Bertelson, P. 1979. Does awareness of speech as a sequence of phonemes arise spontaneously? *Cognition* 7:323-331.

Morais, J., Cluyens, M., and Alegria, J. 1984. Segmentation abilities of dyslexics and normal readers. *Perceptual and Motor Skills* 58:221-222.

Olofsson, A., and Lundberg, I. 1983. Can phonemic awareness be trained in kindergarten? *Scandinavian Journal of Psychology* 24:35-44.

Pratt, A. 1985. *The relationship of linguistic awareness to reading skill in children and adults*. Doctoral dissertation, University of Rhode Island.

Rayner, K. 1985. The role of eye movements in learning to read and reading disability. *Remedial and Special Education* 6:53-60.

Read, C., and Ruyter, L. 1985. Reading and spelling skills in adults of low literacy. *Remedial and Special Education* 6:43-52.

Stanovich, K.E. 1982. Individual differences in the cognitive processes of reading: 1. Word decoding. *Journal of Learning Disabilities* 15:449-512.

Stedman, L.C., and Kaestle, C.E. 1987. Literacy and reading performance in the United States from 1880 to the present. *Reading Research Quarterly* 22:8-46.

Treiman, R. A., and Baron, J. 1981. Segmental analysis ability: Development and relation to reading ability. *In* G. E. MacKinnon and T. G. Waller (eds.). *Reading Research: Advances in theory and practice* (Vol. 3). New York: Academic Press.

Vellutino, F. R. 1979. *Dyslexia: Theory and research*. Cambridge, MA: MIT Press.

Vellutino, F.R. 1985. Phonological coding: Phoneme segmentation and code acquisition in poor and normal readers. *In* J. Kavanagh and D. Gray (eds.). *Biobehavioral Measures of Dyslexia*. Parkton, MD: York Press,Inc.

Wolford, G., and Fowler, C. A. 1983. Perception and use of information by good and poor readers. *In* T. Tighe and B. Shepp (Eds.) *Perception, Cognition, and Development: Interactional analyses*. Hillsdale, NJ: Erlbaum.

Zifcak, M. 1981. Phonological awareness and reading acquisition. *Contemporary Educational Psychology* 6:117-126.