Learning to read presents a considerable obstacle for approximately 4-10% of normal elementary school children, despite what would appear to be a favorable background of intellectual abilities and classroom experience. Such "reading disability" hinders educational progress and, as a consequence, can effect self-esteem, social status, and occupational choice. Some important new discoveries are showing that many instances of reading disability are rooted in some problem in the language domain (for recent reviews, see: Liberman, 1982; Mann, 1986a; Perfetti, 1985; Stanovich, 1982a, 1982b; Vellutino, 1987; Wagner & Torgesen, 1986). Our goal is to review the theoretical and experimental evidence for this position to see how it informs our understanding of reading disability and directs the way towards effective treatment of this very prevalent form of learning disability.

INTRODUCTION

Following from the assumption that reading is primarily a visual skill, many investigators sought to blame early reading difficulty on some malfunction in the visual domain, such as a tendency to reverse letters or sequences of letters (as first noted by Orton, 1937). Scientific research, however, has shown that children deficient in visual-motor and/or visual perceptual skills do not encounter reading difficulty any more frequently than do matched controls (Robinson & Schwartz, 1973). Indeed, only a few instances of reading difficulty can be traced to some difficulty in visual processing (cf. Rayner, 1985: Stanovich, 1985; and Vellutino, 1987, for recent reviews of these findings, though see Pavlidis, 1981, for a somewhat different view). Indeed, rather than being the hallmark of children with reading problems, reversal errors are made by almost all children at some point in their development (Gibson, Gibson, Pick, & Ossler, 1962), and those who confuse "b" and "d" or draw "n" and "s" backwards are no more likely to become poor readers than those who do not (Mann, Tobin, & Wilson, 1987; Simner, 1982). Further, letter and sequence reversals do not account for the majority of the reading errors that children make (Shankweiler & Liberman, 1972). Even those children who have been formally diagnosed as "dyslexic" do not tend to misread "bag" as "dog," or "saw" as "was"—they tend to produce such errors as "butterfly" for "bag" or "swing" for "saw" (Fischer, Liberman, & Shankweiler, 1977). As we shall discuss in a later section, a linguistic explanation accounts more adequately for the types of errors commonly observed.

Other theories about reading disability have regarded the poor readers' problems as the consequence of poor cross-modal integration or a general intellectual deficit. Careful investigation of the ability to integrate information presented to different modalities reveals that the cross-modal integration difficulties are almost always
accompanied by intra-modal integration problems. Both types of difficulty are now regarded as symptoms of poor readers' difficulties with linguistic coding (for a review of this literature, see Vellutino, 1979), and a subsequent section of this paper will discuss this linguistic coding problem and its ramifications.

The evidence with respect to IQ and reading disability is a little less clear cut. Learning to read is a complex task that can be expected to correlate with general intellectual abilities. Rutter (1978) reports a 0.6 correlation between IQ and reading, and notes that reading acquisition for some children will be limited by low intelligence. Yet a low IQ cannot be the sole basis of reading problems, because dyslexic children, by definition, are backward in reading ability but average in intelligence (Rutter & Yule, 1975), and some hyperlexic children are precocious readers despite below average IQ scores (Healy, Aram, & Horowitz, 1982). For children of normal IQ, the interrelationships between the various subskills of reading problems and intelligence increase with age, probably as a result of mutual facilitation (Stanovich, Cunningham, & Feeman, 1984a). However, measures of certain language abilities show a much greater association with reading ability and account for as much as 78% of the variance between individuals who are good readers and those who are poor readers (Mann, 1984b; Mann & Liberman, 1984; Pratt & Brady, in press; Stanovich et al., 1984).

A crucial link between deficient language processes and reading disability is further suggested by two observations. First, children who are speech and language-retarded encounter reading problems at least six times more often than do controls (Ingram, Mason, & Blackburn, 1970), in contrast to the lack of correspondence between reading and other sorts of handicaps (Rutter, 1978). Second, a telling pattern of cognitive strengths and weaknesses for poor readers has emerged from a variety of studies. Disabled readers consistently do worse than excellent readers on many language tasks, but generally do as well on tasks that do not involve the use of language. This dichotomy between poor readers' linguistic difficulties and their success on nonlinguistic tasks is consistent with some newer theories hypothesizing that reading is predicated on spoken language skills. We begin our review of those theories by considering the overlap between spoken and written language processes, and the special linguistic requirements of reading an alphabetic writing system.

LANGUAGE REQUIREMENTS FOR READING

Since writing systems represent language, written language is not a wholly different communication system from spoken language, but is based on spoken language and thereby recruits linguistic processes that the reader already has (Liberman, Liberman, Mattingly, & Shankweller, 1980). Both written and spoken communication require accessing the words of the vocabulary, analyzing the phrases and sentences that those words comprise, and comprehending the message. Experimental evidence has shown us that many of the same processing skills are recruited for reading and listening alike.

A central component of the processing system that serves language is a short-term memory (STM) that holds linguistic material momentarily, pending analysis of the input. Of special significance are findings that whenever the processing of a sequence of printed letters, words, etc. places demands on temporary memory, readers recode from print into some kind of "silent speech," or phonetic representation. Interestingly, this is equally true for English speaking and reading adults (for a review, see Mann, 1986; Perfetti & McCutchen, 1982), for adult users of languages written in nonalphabetic scripts (e.g., Chinese: Tzeng, Hung, & Wang, 1977; Japanese: Erickson, Mattingly, & Turvey, 1977), and for skilled deaf readers (Hanson, 1982). In addition to recruiting language processing abilities, written language places a special
demand on the language faculty. As noted above, all writing systems represent some unit of language. Alphabets, in particular, represent consonant- and vowel-sized segments that are referred to as phonemes.

The primary virtue of alphabetic systems follows from their economy: any word or possible word can be represented by combining a relatively small number of characters. Learning these, together with a set of grapheme-to-phoneme conversion rules, allows readers of an alphabet to read not only highly familiar words, but even previously unencountered words. (In contrast, a skilled reader of a writing system such as Chinese or the Japanese Kanji in which symbols represent units of meaning must have memorized thousands of distinct characters, and even then may have difficulty reading a new or infrequent word.)

The virtue of an alphabet will only be realized, however, if the would-be reader has a conceptual framework for understanding what the letters represent. Unless an individual appreciates the fact that words are composed of ordered sequences of phonemes (i.e., consonants and vowels), the alphabet will make no sense as a transcription of utterances and reading will not be mastered (Liberman et al., 1971; Liberman et al., 1980; Mattingly, 1972). Yet this appreciation of the phonological structure of spoken words (also termed “metalinguistic awareness” or “phonological awareness”) may be difficult to achieve, for phonemes are abstract units of the speech stream that cannot generally be produced in isolation or be physically separated (Liberman, Cooper, Shankweiler, & Studdert-Kennedy, 1967). While speakers and hearers produce and perceive phonemes in the course of processing words, this is performed automatically and not as a conscious activity.

The difficulty of achieving phonological awareness can be hard to appreciate for experienced readers, because of their ability to analyze the internal structure of words. Skilled readers are readily cognizant of such aspects of phonological structure as the fact that “cat” and “hat” differ in one phoneme, namely the first, and share a final phoneme, which is the initial one in “top.” However, two lines of evidence speak to the difficulty of obtaining this knowledge. First, the abstractness of the phoneme may have contributed to the fact that the alphabet was only invented once, and then long after orthographies representing semantic concepts or syllabic units had been in use (Gleitman & Rozin, 1977). Second, developmental studies demonstrate quite clearly that children find larger units such as words easier to isolate and manipulate than smaller syllabic units, and that awareness of phonemes is latest to develop (e.g., Liberman, Shankweiler, Fischer, & Carter, 1974). These findings suggest that the metalinguistic knowledge that is a special requirement of reading may be a source of difficulty for beginning readers.

**READING DISABILITY AND DIFFICULTIES WITH LANGUAGE PROCESSING**

During the past decade, many different studies have uncovered some link between early difficulties in learning to read, and difficulties with one or more aspects of spoken language processing. Such a link has been clearly established not only in English (cf. Mann, 1986a, for a review) but in other languages such as Swedish (Lundberg, Oloffson, & Wall, 1980), Japanese, and Chinese (Stevenson, Stiegler, Lucker, Hus, & Kitamura, 1982). In the case of English, four major areas of language processing have been studied: linguistic short-term memory, phonetic perception, the mental lexicon, and sentence comprehension.

Much of the evidence that we will be citing derives from studies of children in the early elementary grades, although we note that many of the special characteristics of disabled readers at this age appear to hold in adolescence (McKeever & van Deventer, 1975) and beyond (Read & Ruyter, 1985; Russell, 1982; Scarborough, 1984). These
studies have typically compared good and poor beginning readers who, by virtue of either selectional constraints or statistical manipulations, are equated for IQ, familial background and educational experience. The poor readers tend to be reading one grade-level or more below expectation, and the good readers tend to be reading one grade level or more above expectation.

Questions concerning deficiencies in linguistic short-term memory (STM) have given rise to one of the more fruitful lines of research in this field. Although memory impairment has long been recognized as a characteristic of children with reading problems, the nature of the impairment has been better understood only in the last decade. Poor readers generally recall fewer items from short lists of linguistic material than do children who are good readers. This result has been obtained with a variety of stimuli including letters, digits, nonsense syllables, words, and pictures of nameable objects. Reading-disabled children also fail to recall words of spoken sentences as accurately as good readers (Mann, Liberman, & Shankweiler, 1980).

Two findings helped pinpoint the locus of the memory problem. First, recall deficiencies for poor readers are evident regardless of whether the items are heard or seen. Thus the deficit is not restricted to reading or to visual tasks but reflects a more extensive memory problem. Second, when recall tasks are given that carefully avoid the possibility of verbal labeling (e.g., by using nonsense doodle drawings), the performance of good and poor readers is comparable (Katz, Shankweiler, & Liberman, 1981; Liberman, Mann, Shankweiler, & Werfelman, 1982; Vellutino, Pruzek, Steger, & Meshoulam, 1973). Thus the memory impairment is specific to verbal memory processes.

As noted earlier, studies with adults indicate that linguistic material in STM is stored via a phonetic representation; items are represented in terms of "silent speech." Recent evidence also demonstrates the use of phonetic coding in verbal memory by children as young as age four (Elmas, 1975). Noting the specifically verbal memory deficits of poor readers and the reliance of verbal STM on speech coding, Liberman and then Shankweiler hypothesized that the linguistic memory difficulties of poor readers might reflect a problem with using phonetic representation. This interpretation has been supported by numerous experiments. One approach has been to vary the phonetic confusability of the list items. If good readers are better at forming phonetic representations, then they should recall more than poor readers on the lists of phonetically distinct (nonrhyming) items, but when the test is loaded with confusing (rhyming) items, the good readers' superior phonetic skills should work against them, resulting in confusion of the similar items and lowering their performance (as is seen for adults, Baddeley, 1966). This prediction has been confirmed in several experiments, with poor readers' performance less affected by variations in rhyme than that of good readers (Liberman et al., 1977; Mann, Liberman, & Shankweiler, 1980; Olson, Davidson, Kleigl, & Davies, 1984). But it should be noted, however, that the "rhyme effect" is subject to age effects (Olson et al., 1984), subject factors (Hall, Wilson, Humphreys, Tinzmann, & Bowyer, 1983), and task factors (Brady, Mann, & Schmidt, 1987).

Further evidence that phonetic representation in short-term memory is a specific problem for poor readers accrues from studies of the errors that poor readers make when attempting to recall spoken words (Brady et al., 1987; and see Byrne & Shea, 1979, for a related finding). Like good readers, poor readers make transposition errors, recombining the phonetic information from adjacent items in the list, especially when items have phonetic features in common. Although this confirms their use of phonetic coding, a greater frequency of errors suggests that poor readers have less effective coding processes.

These results collectively point to a language difficulty in phonological processing for poor readers that is not limited to the task of reading. The difficulty appears to be...
related to phonetic coding ability, given poor readers' reduced sensitivity to rhyme and their increased tendency to make errors of phonetic transposition. As the differences between good and poor readers' use of phonetic representation can be present even before the children learn to read (Mann, 1984b; Mann & Liberman, 1984), ineffective use of phonetic representation appears to be a cause, and not a consequence, of reading difficulty.

Some attention has been devoted to the possibility that poor readers' short-term memory deficits are based in poor perception. Because remembering something also necessitates that it must first have been perceived, the memory deficit may stem from problems in initial phonetic perception (see Brady, 1986, for a discussion). To date, a number of studies have reported inferior performance by poor readers on speech perception tasks (Brady, Poggie, & Merlo, 1985; Brady, Shankweiler, & Mann, 1983; Godfrey, Syrdal-Lasky, Millay, & Knox, 1981; Merlo, 1986; Snowling, 1980; Snowling, Goulandris, Bowby, & Howell, 1986).

Furthermore, in experiments examining performance on both verbal and nonverbal auditory perception, the perceptual difficulties for poor readers have only been observed for the linguistic stimuli. For example, Brady et al. (1983) reported no reading-group difference in accuracy with environmental sounds (e.g., knocking on a door, firing artillery, frogs croaking) but obtained significant group differences when words were presented. These findings contradict a claim that general auditory processes are responsible for the perceptual deficits (Tallal, 1980a, 1980b), and replicate the pattern in memory research of a specifically linguistic impairment.

The role of phonological processes in verbal memory functioning has been further supported by recent findings that in normal development there is a close link between the efficiency of phonetic skills and recall capacity in verbal STM (Brady, 1986; Case, Kurland, & Goldberg, 1982; Hulme, Thomson, Muir, & Lawrence, 1984; Merlo, 1986). That is, as children get older, increases in phonetic processes parallel improvements in verbal memory, but not in nonverbal recall. When third-grade good and poor readers were tested jointly on a number of phonological and memory tasks, a significant correspondence between the accuracy of phonetic processes and verbal memory capacity (but not nonverbal memory span) was demonstrated, with poor readers less skilled at both (Brady, 1986). Correlations between digit span and naming speed have also been observed (Spring, 1976; Torgesen & Houck, 1980) in similar populations. All of this is consistent with the possibility that STM is a limited capacity system in which the available resources for memory are affected by the efficiency of initial phonological encoding (for a discussion, see Perfetti, 1985).

Phonological impairment has also been implicated in studies of the naming abilities of disabled readers. In younger children, vocabulary size bears some relation to reading ability (see Stanovich et al., 1984a), though good and poor readers often have comparable vocabularies (e.g., Mann & Liberman, 1984; Wolf & Goodglass, 1986). As individuals get older, reading experience itself contributes to superior word knowledge for better readers (e.g., Pratt & Brady, in press), yet there are indications that disabled readers require more exposure to learn the meaning of spoken words (Nelson & Warrington, 1980).

The point that is relevant to our position regarding phonological impairments is the observation that, even when their vocabulary size is not at issue, poor readers may encounter problems with producing the name of an object or event (for reviews, see Katz, 1986; Wolf & Goodglass, 1986). Poor readers have more trouble retrieving the sound structure of low frequency words than do good readers, even when they know the meaning of the word. For them, the phonological information for words may be less accurately represented or less easily accessed (Katz, 1986).

A likely outcome of a lower-level difficulty with phonetic representation in short-term memory would be difficulty repeating and comprehending sentences that place
heavy demands on STM (Mann, 1984b; Shankweiler & Crain, 1986). As mentioned earlier, memory experiments requiring sentence repetition have found reading group differences. Several experiments report differences between good and poor readers on sentence comprehension tasks employing such constructions as relative clauses (Mann, Shankweiler, & Smith, 1985); token test items (Smith, Mann, & Shankweiler, 1987); the easy/eager distinction (Byrne, 1981) and the double object construction (Fletcher, Satz, & Scholes, 1981). In recent experiments, researchers have teased apart whether poor readers have difficulty just on those sentences that are long and place demands on memory operations, or on those that are syntactically complex. By carefully controlling for both sentence length and syntactic complexities, it has been found that reading groups do not appear to differ in their syntactic knowledge, so much as in their ability to use that knowledge when the sentence stresses memory limitations (Fowler, 1987; Mann et al., 1985). Not surprisingly, listening comprehension problems have also been noted for children with reading disability (e.g., Berger, 1978; Kotsonis & Patterson, 1980; Smiley, Oakley, Worthen, Camplone, & Brown, 1977). The correlations that have frequently been found between children’s listening comprehension and reading comprehension (see Stanovich, 1985, for a review) are also consistent with the position that the language underpinnings are a sizable factor in reading ability.

To summarize, poor readers have been found to have a wide scope of language deficits. On various tests of short-term memory, speech perception, naming ability, and sentence comprehension, poor readers have often been found to have difficulty processing language. Whereas the language deficits may be multifaceted, evidence points most strongly to a unitary basis for many instances of poor reading: difficulty with phonological representation. Because this aspect of language processing is centrally involved in reading (as discussed in a previous section), when it is inadequate, the beginning reader can be expected to encounter particular difficulties with reading acquisition.

READING DIFFICULTY AND DIFFICULTIES WITH PHONOLOGICAL AWARENESS

The fact that reading requires an explicit awareness of phonemes appears to pose a problem for many disabled readers. One place in which their lack of phonological awareness is intimated is in their reading errors. Poor readers, and beginning readers in general, tend to be correct about the pronunciation of the first letter in a word, but to have increasing difficulty with subsequent letters, and a particular problem with vowels as opposed to consonants. While these errors relate to the orthographic complexities of English, they also indicate a lack of awareness about the consonant- and vowel-sized segments that alphabets represent (Fisher et al., 1977; Shankweiler & Liberman, 1972).

Other forms of evidence confirm a strong relationship between the degree of linguistic awareness and success in learning to read. Children who are poor readers perform poorly on a variety of tasks that require spoken words to be broken down into syllables or phonemes. Examples of such tasks include syllable and phoneme counting games (Liberman et al., 1973; Liberman et al., 1977; Tunmer & Nesdale, 1985), detection of rhyme (Bradley & Bryant, 1978), and phoneme or syllable deletion (Mann, 1986b; Morais, Cluytens, & Alegria, 1984).

Evidence that children’s awareness of phonemes and syllables actually determines their reading ability has been supported by three lines of evidence. First, phonological awareness skills have been found to predict later success in reading (Blachman, 1983; Bradley & Bryant, 1983; Mann 1984b; Mann & Liberman, 1984). When the metalinguistic skills of four- and five-year olds were measured and related
to their reading ability more than three years later, Bradley and Bryant (1985) found that phonological awareness uniquely accounted for a significant portion of the variance in future reading ability. In evaluating children's awareness at the prereading stage, both phonemic and syllabic units have been utilized. The fact that problems with syllable segmentation can presage reading problems (e.g., Mann & Liberman, 1982) is noteworthy because the alphabet does not represent syllables in any direct way. This raises the possibility that a more general capacity for awareness about any type of phonological segment is related to success in learning to read a phonological transcription such as an alphabet or a syllabary (Mann, 1986b).

A second line of evidence that supports a causal link between phoneme awareness and reading ability concerns the effects of training in metalinguistic awareness on learning to read (Bradley & Bryant, 1985; Elkonin, 1973; Treiman & Baron, 1983; Wallach & Wallach, 1976). Although more research in this area is needed before definitive conclusions can be drawn, research suggests that training in phonological awareness facilitates reading acquisition. For example, using a program that combined explicit training about the phoneme-sized units in spoken words, followed by training in letter-sound correspondences and decoding, Williams (1980) found significant improvement in learning-disabled children's decoding skills, compared to the skills of an untreated control group.

A third line of evidence utilizes path analysis techniques to show that phoneme segmentation skills are directly related to reading performance (Lundberg et al., 1980; Tunmer & Nesdale, 1985) and spelling (Torneus, 1984). Taken together, all three lines of evidence suggest that acquiring metalinguistic awareness of the phonological units of language is a necessary precursor to learning to use an orthography that transcribes those units.

However, it must also be mentioned that some investigators have argued that linguistic awareness is developed as a consequence of reading instruction, particularly phonics-oriented reading instruction. One study investigated phonemic segmentation ability in matched groups of literate and illiterate Portuguese adults (Morais et al., 1979). The literate group was superior to the illiterate group, indicating that reading experience may be responsible for this skill. Similarly, Chinese readers who had not been introduced to an alphabetic script were less able to perform a phoneme manipulation task than those who had (Read, Zhang, Nie, & Ding, 1986). Another study demonstrated that phonics-oriented reading instruction was strikingly more effective in developing phoneme awareness than was sight-word instruction (Alegria, Pignot, & Morais, 1982). Apparently, awareness of phonemes is enhanced by methods of instruction that direct attention to the phonetic structure of words, and may even depend upon it.

Yet, the experience of learning to read an alphabet cannot be the only factor behind whether children achieve phonological awareness or not. Some children become aware of phonemes without being taught to read an alphabet (Mann, 1986b), and others fail to become aware despite years of educational experience. This latter point is aptly shown by a contrast between a group of six-year-old skilled readers and ten-year-old disabled readers who were matched for reading ability: the disabled readers performed significantly worse on a phoneme awareness task, even though they would be expected to have had considerably more reading instruction than the younger children (Bradley & Bryant, 1978). Studies of adults who were functionally illiterate despite years of instruction (many were high school graduates) make the same point (Pratt & Brady, in press; Simpson & Byrne, in press). In such populations, reading ability is still linked to phonological awareness, and illiterate subjects who possess phonological awareness are more likely to achieve literacy than those who do not (Liberman, Rubín, Duques, & Carlisle, 1985; Read & Ruyter, 1985).
All in all, the relationship between phonological awareness and reading ability may best be viewed as a complex, two-way street. Awareness of the phonological elements in spoken words clearly facilitates the task of learning what letters symbolize. On the other hand, reading instruction, particularly a phonics approach, does generally augment metalinguistic awareness. However, for some individuals there is a fundamental difficulty achieving metalinguistic awareness that is not due to a lack of educational experience.

PRACTICAL APPLICATIONS

One of the benefits of the research described herein is the direction it provides for practical applications. The convergent evidence for the linguistic basis of reading problems provides a valuable guideline for their diagnosis and treatment. As a first step, the research tells us most clearly which cognitive processes are not implicated in reading disability. The various nonlinguistic treatment programs that have been promulgated (such as large-motor activities like balance-beam walking; drug treatment of cerebellar-vestibular functioning; visual perception training; eye movement practice; stress reduction, etc.) cannot be expected to alleviate the language difficulties involved in reading problems (see Stanovich, 1985, for discussion). Similarly, instructional programs that incorporate practice in nonlinguistic activities such as labeling environmental sounds or that suggest “teaching to the right hemisphere” are not supported by what is known about the reading process or about the cognitive deficits of disabled readers.

More optimistically, the research points the way toward effective approaches in the identification of reading problems, and for appropriate instruction and remediation. The two areas reviewed in this paper, underlying language abilities and phonological awareness, are both relevant in this regard. We will briefly note some of the practical implications of this literature, and will indicate available sources for more extensive treatment of this topic. In attempting to identify children at risk for early reading problems, tests of phoneme and syllable awareness look particularly promising. As noted earlier, several studies have reported that phonological awareness skills in kindergarteners are causally related to the later acquisition of reading (Bradley & Bryant, 1985; Lundberg et al., 1980; Mann, 1984b; Mann & Liberman, 1984; Mann et al., 1987; Stanovich, Cunningham, & Cramer, 1984). Other phonological abilities such as verbal short-term memory (Jorm, Share, Maclean & Matthews, 1984; Mann, 1984b; Mann & Liberman, 1984) and object naming (Wolf & Goodglass, 1986) have also been found to predict later reading success. It remains to be determined what the interrelationships of these language processes are. Nonetheless, the predictive value of assessing early language abilities has been convincingly demonstrated, and would be advantageous in standard screening procedures as well as in evaluation of children known to be at risk (e.g., children with familial histories of dyslexia; Vogler, DeFries, & Decker, 1985). Correspondingly, assessment of school-age children who are encountering reading difficulty should include measures of phonological awareness and underlying language processing skills in order to determine whether language deficits are implicated, or whether the reading problem has other origins (e.g., attentional problems, motivation, etc.)

The importance of phonological awareness concepts for reading acquisition also has implications for beginning instruction. As noted in the previous section, several training studies obtained beneficial results from training in phonological awareness on reading or reading-related skills. These empirical findings, together with the theoretical framework on the importance of phonological awareness for learning to read, lead us to recommend that pre-reading training incorporate much more
systematic introduction to the phonological units of language. (This can involve
word play, learning nursery rhymes, etc. Some excellent suggestions are available in
Liberman, Shankweller, Blachman, Camp, & Werfelman, 1980; see also Williams,

When a child is ready for formal reading instruction, the use of a phonics approach
is widely advocated as the most direct and facilitative method. Many have argued
cogently that phonics-based instruction most effectively meets the cognitive and
language requirements in reading (for example, Chall, 1979; Calfee et al., 1973;
Liberman et al., 1980). We refer the reader to these excellent sources and note also
that the Orton Dyslexia Society¹ is a valuable source of information about available
techniques and current methods.

Within this framework, there is also strong consensus that decoding ability is
Mann, 1984b; Perfetti & Roth, 1981; Samuels, 1979; Stanovich, 1982a, 1982b, 1985;
Vellutino, 1979). Research indicates that the ability to translate the graphemic
symbols into a phonological representation rapidly and automatically accounts
in large measure for a reader's ability to access word meanings and to make use of
context (Perfetti, 1985; Stanovich, Cunningham, & Feeman, 1984a). Thus decoding
skills need to be emphasized for all beginning readers, and especially for poor
readers whose memory deficits impede the process.

Remediation recommendations are an extension of the approach described here.
Investigations with older children and illiterate adults find ongoing deficits in
phonological awareness (Liberman et al., 1985; Pratt & Brady, in press; Read &
Ruyter, 1986; Simpson & Byrne, in press) and in memory (McKeever & Vandeventer,
1975; Olson et al., 1984). The results of such experiments showing persistent deficits
indicate the need, whatever the age of the would-be reader, for inclusion of training
in linguistic awareness, and for overlearning decoding skills. With the recent
advances in our understanding of reading disability, we can look forward to a
proliferation of appropriate procedures and materials for intervention purposes.

CONCLUSION

It is generally agreed that many instances of reading difficulty are language-based.
We have reviewed the theoretical and experimental findings about the role of
language in skilled reading, and the evidence that early reading disability tends to
reflect problems in one or both of two areas: language processing and metalinguistic
awareness. In future research it will be important to continue studying the
relationship among children's reading ability, metalinguistic abilities, and spoken
language processes. Much remains to be ascertained about the normal development
of each ability—their antecedents and their interrelations as well as their
pathologies. Ultimately, clarification of the cognitive abilities that are closely
linked to reading skill will have further implications for methods of reading
instruction, for assessment of reading problems and for pre-reading activities that
may reduce the incidence of reading difficulty.

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**FOOTNOTES**

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