

The Linguistic Basis of Reading Disorders: Implications for the Speech-Language Pathologist

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Recent theory and clinical insight have emphasized the linguistic aspects of reading and reading disorders. As a result, some speech-language pathologists are playing a more integral role in the identification, assessment, and remediation of reading disorders. This paper discusses the linguistic basis of reading and reading problems, and provides some guidance to speech-language pathologists on how they can use their knowledge of language to deal more effectively with developmental reading disorders.

Clinical insights and recent developments in psycholinguistics have emphasized the linguistic rather than the visual processing aspects of reading. This change in emphasis has led some speech-language pathologists to play a more integral role in the identification, assessment, and remediation of children with reading disorders. However, not all speech-language pathologists are comfortable with this new role. The purpose of this paper is to describe the linguistic basis of reading and reading disorders and to provide some guidance to speech-language pathologists on how they may use their language expertise in dealing with developmental reading disorders.

The paper begins with a discussion of the forces that, for many years, made oral language and reading disorders appear to be two unrelated problems. A model is then presented to illustrate the similarities between reading and oral language processing. In the next section, the linguistic basis of reading disorders is discussed. Finally, some suggestions are presented concerning the role the speech-language pathologist can play in the identification, assessment, and remediation of reading disorders.

Changes in the Relationship of Reading and Language Disorders

At least two forces appear to have promoted and sustained the distinctiveness of oral language and reading disorders (Carrow-Woolfolk & Lynch, 1982). First, reading was viewed for many years as primarily a visual skill that involved learning to match letters to sounds. Reading problems were thus thought to be caused by deficits in visual perceptual processes (Hermann, 1959). Because speech-language

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pathologists had little formal training in assessing or remediating visual perceptual deficits, it was understandable that they took little interest in reading disorders.

The second force operating to divide oral language disorders from reading disorders was the perception that reading was the primary concern of curriculum and reading specialists. These specialists generally treated reading as a subject to be learned in the same manner that history, math, and science were learned (Carrow-Woolfolk & Lynch, 1982). Because speech-language pathologists were not generally involved in curricular issues, it was not surprising that the differences rather than the similarities between these professionals were emphasized.

The strength of these two forces began to dissipate in the 1970s as reading specialists became dissatisfied with perceptually based reading programs and theories that emphasized the visual perceptual basis of reading gave way to ones that focused on the linguistic basis of reading. Researchers in the 1970s began to explore more fully the role of cognitive processes other than visual ones for reading (Gibson & Levin, 1975; Stanovich, 1982a,b; Vellutino, 1979). This research examined such factors as attention and memory as well as the linguistic processes involved in reading. As reading theorists began to develop and refine their language-based theories of reading (e.g., Liberman, 1983; Mattingly, 1972; Vellutino, 1977; 1983), the assessment and remediation of children with reading disorders began to incorporate linguistic factors. Because speech-language pathologists were already targeting linguistic processes in their therapy with language-disordered children, it was not long before some speech-language pathologists began to see links between oral language and reading problems (Rees, 1974; Stark, 1975). In the next section, a model illustrating the relationship between reading and oral language processing is presented.

A Model of Reading and Oral Language Processing

Reading can be defined as a cognitive process by which one derives meaning from printed symbols. As mentioned above, recent theories of reading have concentrated on the linguistic aspects of this process (e.g., Liberman, 1983). As a result, we have come to realize that reading shares much in common with oral language. This relationship is captured by the information processing model shown in Figure 1. This model, though unique, shares components with other processing models (e.g., Cutting & Pisoni, 1978; Thomson, 1984). In the initial stage of reading and oral language processing, distinct operations are involved. However, at subsequent stages, reading and listening share similar knowledge and processes.

Perceptual Analysis

Perhaps the most basic difference between reading and oral language processing lies in the input. For spoken language, the input is of course an auditory signal, whereas for reading, the input is a visual stimulus. Thus, the initial stage of perceptual analysis for oral language involves auditory processes, and the initial analysis for reading involves visual perceptual processes. In auditory analysis, the segmental and suprasegmental auditory features of spoken words are identified. In

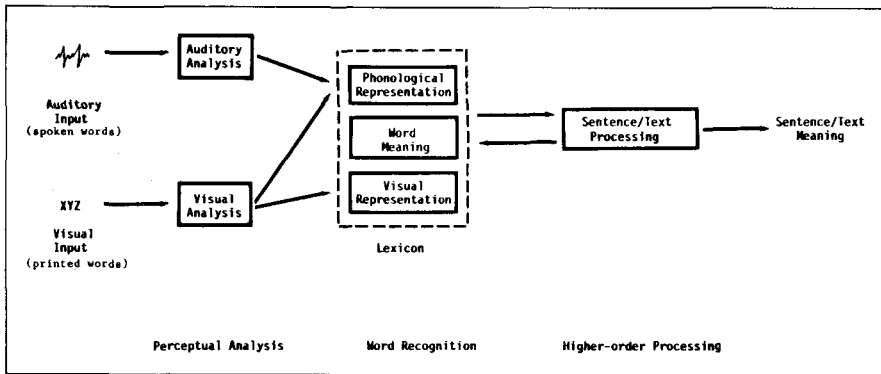


FIGURE 1. A model of reading and oral language processing.

an analogous fashion, in visual analysis, segmental (i.e., letters) and suprasegmental or whole-word features (i.e., word shape and length) are identified.

Word Recognition

Reading and oral language begin to share similar knowledge domains and processes at the word recognition stage. During this stage, the features identified in perceptual analysis are used to access the mental dictionary or lexicon. This lexicon is the same whether one is reading or processing oral language. In other words, the reader and the listener use the same storage of word knowledge. In oral language processing, the lexicon is accessed by way of a word's phonological representation. In contrast, there are two ways to access the lexicon in reading (Baron, 1977). In one approach, a word is accessed directly on the basis of its visual characteristics. This approach is variously referred to as the direct, visual, look and say, or whole-word route. When reading by this route, the reader locates the word in the lexicon whose visual representation contains the same segmental and/or wholistic features as those identified by visual analysis. In other words, a visual match is made between the stimulus input and a representation in the reader's lexicon.

In alphabetic languages, such as English, there is a second route that may be used to access the lexicon (Baron, 1977). This involves identifying words indirectly by taking advantage of grapheme-phoneme correspondence. This route is referred to as the indirect or phonetic approach. When reading by this route, the reader uses sound-spelling rules to recode the visually perceived letters into their corresponding phonemes. These phonemes are then blended together to form a phonological sequence. Finally, to recognize this sequence, a word is located in the lexicon whose phonological representation matches the sequence.

Reading by the phonetic route is thus similar to oral word recognition. In each case, a word may be recognized by first deriving its phonological representation. There is one important difference, however. In order to successfully use the phonetic route in reading, one must be explicitly aware of the phonological structure of words (Treiman & Baron, 1981). That is, one must know that words are comprised of discrete phonemic segments. In contrast, in oral word recognition the listener

need not be explicitly aware of the sound segments of words. In fact, young children who have little explicit phonological awareness usually have no difficulty in oral word recognition (Hakes, 1982).

Development of Word Recognition

The route used to access the lexicon in reading depends to a large extent on the sophistication of the reader (Barron, 1981; Frith, 1985). A brief discussion of the development of reading is appropriate at this point. In the development of reading, children appear to go through various stages in which they make different uses of the visual and phonetic routes. In the initial stage of reading, children rely heavily on the visual route for word recognition (Torrey, 1979). During this stage, words are recognized by their visual configurations. The first letter of a word, as well as wholistic features such as word length, seem to serve as primary cues (Marsh, Friedman, Welch, & Desberg, 1981). Letter order and other segmental features are largely ignored at this point. Although the child may develop a sizable sight vocabulary at this stage, he is limited to reading only those words for which he has a visual representation and is unable to recognize words with which he may be familiar, but never has seen in print.

In the second developmental stage, the child learns the sound-spelling correspondence rules and can read novel words using the phonetic approach (Frith, 1985). This is not an easy task, however. As noted above, the use of sound-spelling rules requires explicit awareness of the sound segments within words. These segments, however, are not readily apparent to the young child (Treiman & Breaux, 1982). Because of the way speech is articulated, phonetic segments are merged or blended together in the acoustic signal (Lieberman, Cooper, Shankweiler, & Studdert-Kennedy, 1967). For example, the word *cat* is produced as one acoustic event with no detectable acoustic segments that correspond to its three written symbols. The child, therefore, must infer the phonetic segments from spoken words in order to construct the links between sounds and their symbols. Given the complexity of this task, it is not surprising that it takes several years of instruction for most children to acquire fully the ability to use the phonetic route.

Reading by the phonetic route encourages children to attend to the position and sequence of sounds/letters in words (Barron, 1981). As a result, children's visual representations of words begin to include more segmental detail. These representational changes allow the child to move to the final developmental stage of word recognition. In this stage, the child directly recognizes words on the basis of orthographical patterns (Frith, 1985). A direct access route is employed; but, unlike that of the first stage, segmental composition and order predominate as cues for word recognition.

Higher-order Processing

In the word recognition stage, the reader or listener is usually able to derive word meaning. However, to comprehend more fully what is written or said, higher-order processing is necessary. In this processing, reading and oral language share linguistic and conceptual knowledge (Kintsch & Kozminsky, 1977). At the level of

sentence processing, both rely on the same syntactic and semantic rules. Also at this level, reading and oral language may involve similar memory codes. Both reading and listening often require that information from the beginning of a sentence/phrase be held in short-term memory until the arrival of other information. In oral language processing, this information generally is stored in a phonetic code. A similar memory code is often used in reading (Banks, Oka, & Shugarman, 1981; Conrad, 1964; Perfetti & McCutchen, 1982). That is, although written words begin as visual stimuli, once recognized they usually are held in a phonetic form for further processing. Therefore, regardless of whether one is reading or listening, verbal information may be stored temporarily in a speech-sound code.

Higher-order processing also takes place beyond the sentence level. Reading and listening typically involve the comprehension of larger discourse units or passages. This processing in both reading and oral language may be referred to as text-level processing. At this level, reading and listening continue to make use of the same knowledge base. In comprehending oral or written text, the reader or listener employs similar knowledge about pragmatics, discourse structure, store grammars, and scripts (Stanovich, 1982a).

Higher-order processing for reading and oral language share one important additional component. In both reading and listening, higher-level processes also operate in a top-down or parallel manner to derive meaning. In oral language, the listener may use contextual cues to assure accurate word recognition (Marslen-Wilson & Welsh, 1978). The same is true for reading (Stanovich, 1982b). The reader, through sensitivity to syntactic, semantic, and text-level information, is able to develop hypotheses about upcoming words (Smith, 1971). Top-down processing also serves to improve comprehension. Readers and listeners both make use of contextual information in their interpretation of sentences and text (Bransford & Johnson, 1972).

Although reading and oral language processing have many similarities, one must not overlook their differences. The structure and function of written and oral language usually are quite different. As a result, the reader and listener may use different strategies for higher-level processing. For example, the permanence of written text allows the reader to easily backtrack for missed information or reverification. Backtracking is not as easily accomplished in oral language; however, the listener may use a strategy involving feedback requests to obtain similar, if not better, information. Nickerson (1981) discusses many other important similarities and differences between written and oral language.

Reading Disorders As Language Problems

Most current theories explain reading disorders in terms of linguistic deficits (e.g., Liberman, 1983; Thomson, 1984; Vellutino, 1979). Such a view is consistent with the model discussed in the previous section. Because reading and oral language share knowledge and processes, breakdowns at one or more levels of linguistic processing could be responsible for many developmental reading disorders. For example, deficits in sentence- or text-level processing could cause problems in the comprehension of written material. In addition, a poorly developed vocabulary (i.e., lexicon) could significantly affect written word recognition.

Besides being consistent with current views of the reading process, language-based theories of reading disorders have received both practical and empirical support. For example, it frequently has been reported that children with a history of speech and language impairment experience difficulties learning to read (see Maxwell & Wallach, 1984, and Weiner, 1985, for a review of this research). More importantly, studies of reading-disordered children often have found deficits in these children's oral language. These deficits have included poorly developed vocabularies (Fry, Johnson, & Muehl, 1970), deficiencies in the use of morphology or syntax (Fletcher, Satz, & Scholes, 1981; Vogel 1974, 1977; Wiig & Semel, 1975), and difficulties in the comprehension of syntactic structures (Byrne, 1981; Fletcher et al., 1981; Wiig & Semel, 1976).

Language problems are not apparent, however, in all reading-disordered children. Some poor readers appear to have normal language abilities, and have no history of speech and language impairment. Many of these children, however, may have more subtle language deficits. For example, some children with reading disabilities have text-level processing deficits that may not be readily apparent on formal language tests. Berger (1978) and Smiley, Oakley, Worthen, Campione, and Brown (1977) have shown that reading-disordered children are poorer than normal readers in the recall and comprehension of oral as well as written narratives. These authors concluded that many poor readers may suffer from a general text-level processing deficit that affects both oral and written language comprehension. Others have proposed that reading-disordered children's comprehension problems in written and oral language arise from their ineffective use of knowledge about discourse or story structure (Short & Ryan, 1984). Short and Ryan (1984) demonstrated that limited training in the use of story grammar strategies (i.e., use of "wh" questions about settings and episodes) significantly improved poor reader's comprehension performance. For additional discussion of the text-level processing deficits of poor readers; see Donahue (1985) and Snyder (1984).

Children with reading disabilities also may have other less apparent oral language deficits. One prominent recent theory proposes that many reading-disordered children have subtle phonological deficits (Frith, 1981; Liberman 1983; Torgesen, 1985). In support of this theory, research shows that reading-disordered children often exhibit (a) a lack of phonological awareness, (b) problems in encoding or representing verbal stimuli phonologically, and (c) deficits in the retrieval of phonological information from memory.

Numerous studies have demonstrated a relationship between a lack of explicit awareness of the sound segments in speech and reading difficulties. Poor readers have been observed to perform less well on phoneme and syllable segmentation tasks than good readers (Bryant & Bradley, 1981; Liberman, Shankweiler, Fischer, & Carter, 1974; Treiman & Baron, 1981). Reading-disordered children also show deficits on tasks involving rhyming or alliteration (e.g., Bradley & Bryant, 1978).

Other research indicates that many reading-disordered children have deficits in the short-term memory of verbal information (Cohen, 1982; Jorm, 1983; Torgesen, 1985). Studies have consistently found that poor readers do less well than good readers in the short-term recall of spoken or printed linguistic information. No such differences, however, have been observed in nonverbal short-term memory (see

Torgesen, 1985 for an excellent review of this research). It is suggested that poor readers' deficits in verbal memory are the result of difficulties in using phonologically based codes to store verbal information. Poor readers may generate inadequate phonological codes and/or rely on other forms of memory storage (e.g., visual & semantic) for linguistic material (Byrne & Shea, 1979; Shankweiler, Liberman, Mark, Fowler, & Fischer, 1979).

Another aspect of reading-disordered children's phonological processing deficits is difficulties in naming. In confrontation naming tasks, reading-disordered children often perform poorly, demonstrating frequent substitutions and circumlocutions (Denckla & Rudel, 1976a; German, 1982). Additionally, in tasks involving the rapid "automatized" naming of letters, digits, colors, or common objects, poor readers perform slower than good readers (Blachman, 1984b; Denckla & Rudel 1976b; Spring & Capps, 1974; Wolf, 1982). These naming deficits may arise from difficulties reading-disordered children have in retrieving phonological codes from long-term memory (Ellis, 1981). In other words, reading-disordered children may have subtle problems in accessing the phonological representations of words from their lexicon.

The various difficulties reading-disordered children have in phonological processing may significantly disrupt their development of written language. Recall that reading by the phonetic approach requires that children learn complex sound-letter correspondence rules. A lack of explicit awareness of sound segments and/or difficulties in the encoding or retrieval of phonological information would make these rules particularly difficult to learn. Phonological deficits might also affect oral reading by the whole-word approach. In order to read aloud by way of this route, a word's phonological representation also must be accessed. Thus, difficulties in the retrieval of phonological memory codes could disrupt the fluency of oral reading. Finally, because written material is best held in a phonetic form in short-term memory until higher-order processing can be completed, a phonetic coding deficit might also lead to problems in the comprehension of written text (Mann, Shankweiler, & Smith, 1984; but see Byrne, 1981).

Implications for the Speech-Language Pathologist

Because the speech-language pathologist is a specialist in the area of language, he/she is, in many cases, the best qualified to identify, assess, and remediate the language-based reading problems exhibited by many reading-disordered children. This is not to say, however, that the speech-language pathologist should take over the duties of the reading specialist. Rather, speech-language pathologists should collaborate with reading specialists and other professionals to develop more effective identification, assessment, and intervention programs.

Identification

Research suggests that the speech-language pathologist's collaboration may be particularly useful in the early identification of children who are at risk for reading problems. Mann & Liberman (1984) have shown that measures of phonological

awareness and short-term verbal memory were quite effective in identifying kindergarten children who had reading problems at the end of first grade. Blachman (1984b) has reported that rapid automatized naming of letters and colors may be an effective predictor of reading achievement. In addition, recent investigations suggest that tasks involving the repetition of multisyllabic words may be helpful in distinguishing between good and poor readers (Catts, 1984; Kamhi & Catts, 1985). Because the speech-language pathologist generally is familiar with these types of tasks and the underlying cognitive-linguistic abilities they tap, he/she can contribute much to the development and implementation of screening programs.

The speech-language pathologist also should be cognizant of the relationship between developmental language disorders and reading problems. In most cases, the speech-language pathologist has the earliest and most extensive professional contact with young language-disordered children. Therefore, he/she is in the position to assure that these children receive adequate placement for potential reading problems.

Assessment

The speech-language pathologist can make significant contributions to the assessment of children who have or are at risk for reading disorders. These children need to have a full evaluation of the language skills that are important for reading. The speech-language pathologist is usually the best qualified to assess these skills. In this assessment, many of the testing instruments traditionally used for oral language evaluation can be employed to provide information about lexical, syntactic, and semantic processing. These might include such tests as the Test of Language Development (Newcomer & Hammill, 1977) the Token Test for Children (DiSimoni, 1978) or the Test of Adolescent Language (Hammill, Brown, Larsen, Wiederholt, 1980). See Wallach (1982) for other suggestions in this regard. An assessment battery also should include tasks that measure phonological awareness (e.g., the Lindamood Auditory Conceptualization Test, Lindamood & Lindamood, 1971). Finally, tasks that are sensitive to discourse or narrative processing need to be included. See Johnston (1982) and Culatta, Page, and Ellis (1983) for more specific information concerning the latter tasks.

Whereas the speech-language pathologist is the primary individual to administer language tests, the reading specialist or school psychologist usually will be the one to test reading abilities. The speech-language pathologist, however, should be familiar with these assessment procedures. He/she should have working knowledge of the common achievement tests, such as the Woodcock Reading Mastery Tests (Woodcock, 1973), the Wide Range Achievement Test (Jastak & Jastak 1978), and the Peabody Individual Achievement Test (Dunn & Markwardt, 1970) as well as an understanding of what aspects of reading are measured by the subtests of each of these instruments. This knowledge will allow the speech-language pathologist to interpret achievement scores, and in turn, to provide a comprehensive evaluation of the oral and written language problems experienced by children.

Remediation

The speech-language pathologist also can play an important role in remediation. Many of the children on his/her caseload will be experiencing difficulty in reading.

For some of these children the same linguistic deficits that are disrupting their oral language will be interfering with their written language. In these cases, the speech-language pathologist should take an integrative approach to language therapy. Therapy procedures and materials can be developed that simultaneously target processes crucial to both written and oral language. For example, therapy directed at increasing knowledge of morphological or syntactic structures can facilitate oral language as well as reading comprehension. Specifically, the speech-language pathologist might train children to understand and construct increasingly more complex phrases/sentences using both spoken and printed words. A training procedure similar to this has been shown to improve reading comprehension in poor readers (Weaver, 1979; White, Pascarella, & Pflaum, 1981). The speech-language pathologist also may be able to improve reading comprehension in language-disordered children by facilitating text-level processing. In this case, the speech-language pathologist might train children to use comprehension strategies involving self-questioning, imagery, elaboration, or text structure identification. These strategies which have often been used to facilitate oral language comprehension, also seem to be effective in improving reading comprehension (Bransford, Stein, & Vye, 1982; Eeds, 1981; Levin, 1973; Short & Ryan, 1984; Wong & Jones, 1982).

For some language-disordered children, the most significant aspect of their written language problem is word recognition (Kamhi & Catts, 1985). Because these children's word decoding skills are so poor, therapy directed at higher-order processing may be of limited value to reading performance. In these cases, the speech-language pathologist might work directly on phonological awareness and sound-letter correspondence. Research suggests that this training may be effective in improving children's word recognition skills (Williams, 1984). The speech-language pathologist's knowledge of speech and language and his/her experience in training metalinguistic skills in language therapy should allow him/her to effectively implement such a training program. Blachman (1984a), Lewkowicz (1980), Mann & Liberman (1984), and Williams (1984) provide some specific suggestions for phonemic awareness training. The tasks described by these authors vary in complexity, and therefore, also vary in the cognitive-linguistic demands they place on the child. One should be careful to choose the appropriate task for a given child. For younger children (4–5-years-old), tasks should be used that focus children's attention on the sounds of words. This might involve reciting nursery rhymes, or reading stories that contain frequent sound repetitions (e.g., Dr. Seuss, 1965). For older children (6–8 years-old), one might more directly train phonological awareness by using segmentation tasks or the elision technique (Rosner, 1973; 1975). In the latter task children are asked to say a word after adding or omitting a syllable or phoneme (e.g., say the word *cowboy* without *cow* or say the word *at* after adding an *s* to the beginning).

The speech-language pathologist can also contribute to remediation of the reading problems of children who are not on his/her caseload, but who have subtle language deficits. Many of these children need to increase their phonological awareness in order to improve their word recognition skills. Others may have adequate decoding skills, but have text-level processing deficits that are disrupting

their reading comprehension. In these situations the speech-language pathologist should work together with the reading specialist to design the most effective intervention program.

Summary

We have described the relationship between reading and oral language processing and have proposed that language deficits underlie many developmental reading disorders. Given the linguistic basis of many reading disorders, we have argued that speech-language pathologists are well-qualified to play an important role in the identification, assessment, and remediation of reading disorders. The nature and extent of this role will be determined, in part, by the clinical setting in which the individual speech-language pathologist is involved. In most cases, however, the most important factor influencing the speech-language pathologist's involvement with reading problems will be his/her own interest and initiative. It is hoped that this paper will encourage speech-language pathologists to take an integrative view of language impairments, and extend their concern and expertise to written as well as oral language problems.

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