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Dyslexia: A Deficit in Verbal Processing

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B.A., University of Montana, 1982

Presented in partial fulfillment of the requirements for the
degree of Masters of Communication Sciences and Disorders.

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Since the turn of the century dyslexia has attracted increasing attention from physicians, neurologists, psychologists, educators, and parents. Eighty years of research has brought us little closer to understanding this disorder. A debate continues amongst researchers and practitioners as to the definition and use of the term "dyslexia", the etiology of this disorder, and the remedial implications.

This writer found the following criteria to be used most often across the literature in describing dyslexia.

Dyslexia is a learning disability. It is characterized by a severe reading impairment in which the reading level falls at least two years below that expected by virtue of the child's age and intelligence quotient (Denckla, 1979). Dyslexic children demonstrate the absence of any evident basis for difficulties in learning. Sensory acuity is intact, (e.g. absence of deafness or blindness), and they lack gross physical abnormality (e.g. cerebral palsy). The absence of a gross neurological abnormality such as receptive aphasia is a criteria, but not to the exclusion of a possible central nervous system dysfunction. The dyslexic child should demonstrate at least normal intelligence, and the absence of social deprivation, environmental disadvantages and pronounced emotional disorders. Some researchers such as Forness (1982), and Vellentino (1979), believe that the dyslexic child should also demonstrate a deficit in one or more of the underlying processes involved in understanding or using written or spoken language: 1) visual perception and visual memory; 2) intersensory integration; 3) serial order recall; and 4) verbal processing.

In general, the literature is unclear as to the use of a specific definition such as the one just described. Poor definition of measurement

criteria and the inadequacy of measurement tools are the major factors compounding the difficulty in formulating a single definition for dyslexia. For example, there is no widespread agreement on how to operationally define intelligence. Furthermore, intelligence testing is dependent on the etiological theory of dyslexia. For example, if this theory is based on a spatial processing deficit, then it would be counter-productive to use an I.Q. test which requires spatial reasoning and visualization (Stanley, 1982). Intelligence tests are not devoid of the influence of successful reading and academic experience. The dyslexic child may be penalized by the nature of his disability, and his recorded I.Q. may be lower than his actual potential. There are more weaknesses in the definition of dyslexia. The role of oculomotor dysfunction is difficult to define when visual acuity is intact. Controversy exists regarding the validity of an optometric exam and its ability to distinguish normal readers from dyslexics (Benton and Pearl, 1978). This has significant relevance to those theorists who proclaim that dyslexia is a deficit in visual perception. The literature does not make a clear distinction regarding neurological involvement. Excluded from the population of study are those children demonstrating "gross neurological involvement", (Russell, 1982). Gross neurological involvement is defined by Russell (1982, as "definitive tissue damage with a high probability of multiple handicaps." However, this definition does not address the issue of minimal brain damage, hypothesized to cause dyslexia (Denckla, 1979; Ceci, et al., 1981). This issue appears to be avoided in the literature and yet the assumption seems to be made that there is neurological involvement to some degree. The literature is also unclear regarding measurement tools designed to evaluate emotional and social deprivation factors.

This information is typically gathered via case history from parents or teachers. This type of information gathering has been susceptible to subjective interpretation. Inadequate recordkeeping in a school setting may jeopardize the generalization of any findings of the population of study. An additional compounding factor is the literature's inconsistent use of terminology. The term "poor reader" appears to be used interchangeably with the term "dyslexic." However, the terminology also includes "specific dyslexia", "reading problems", and "reading retardation." A distinction is not clearly made in the literature between each of these terms. The term "poor reader" met the majority of the definition criteria, and therefore will continue to be regarded as a synonym to dyslexia. Considering the confusion inherent in past and present literature on this topic generalizations of research findings must be approached cautiously.

A subtle shift can be observed in the literature regarding research emphasis. Early work in the 1960's by Morgan and Kerr (Koehnke, 1983) set the stage for a medical-based model. They hypothesized that dyslexia was due to specific brain damage (Koehnke, 1983). Theorists such as Orton and Delacatto continued to rely on this model as they hypothesized that dyslexia was due to incomplete cerebral dominance (Koehnke, 1983; Delacatto, 1963). However, in the mid-seventies theorists such as Johnson and Myklebust, Elkonin, Velluntino, and Russell began to emphasize processes involved in the operation of reading as the focus of their research (Johnson and Myklebust, 1967; Elkonin, 1963; Velluntino, 1975, 1979; Russell, 1982). This shift in attention may have been due to the increased emphasis toward behavioral components of learning disabilities, regardless of etiology (Foreness, 1982). As Klausen stated, "there are no indicators that reading disability will ever be traced back to a single etiological factor" (as cited in Denckla, 1979). Therefore, the emphasis in research may

have shifted toward an increased understanding of that process (verbal), which is believed to underly all other deficits related to the operation of reading. Understanding of the process or processes used by the dyslexic child may aid in implementing direct intervention strategies.

Given that a shift has occurred throughout the literature toward an increased understanding of underlying processes, what is the relationship of verbal processing to other processes involved in reading?

- A deficit in visual perception and visual memory implies that there is a dysfunction in the initial or sensory, storage/feature detection stage of processing. This may be viewed as a peripheral deficit as opposed to a deficit at a higher level of processing in which graphic and phonetic information is integrated, (i.e. central nervous system involvement). The dyslexic child has been described as demonstrating poor visual-motor, visual-discrimination, and spatial orientation skills.
- * However, studies have not provided definitive evidence to support the contention that poor readers are "abnormal" in relation to "normal" readers in visual perception. For example, normal readers and dyslexics did not differ significantly in visual analysis of similarities and differences of pictorial concepts (i.e. non-verbal material)(Velluntino, 1979). Furthermore, research by Russell (1982) regarding visual discrimination skills indicates no significant difference between dyslexic and normal control groups on the average number of errors committed. The tests conducted in Russell's research were based on the observation that dyslexic children tend to confuse letters that are mirror images (e.g. "b" for "d" reversals). Visual memory deficits were addressed by Velluntino and his associates, (Velluntino, et al., 1972, 1973; Velluntino, Harding, Phillips, Steger, 1975). They concluded that poor readers do not sustain

any deficiency in short- or long-term visual memory, or in the perception of non-verbal material. A significant difference was found between normal and poor readers on the ability to visually process verbal material. Velluntino and his associates presented evidence that children with dyslexia are impaired in their ability to learn and transfer a visual-verbal relationship similar to those involved in learning to read (Velluntino, Harding, Phillips, Steger, 1975). Groups of poor and normal readers were given pair-associates and transfer tasks under either visual-visual or visual-verbal learning conditions. Results indicated an equal performance level for poor and normal readers on visual-visual paired association tasks, but normal readers performed significantly better on visual-verbal tasks. The poor reader was viewed as "deficit in prerequisite (transfer) skills that are unique to a given stage of reading development; and because of cumulative deficiencies at subordinate levels, he does not achieve mastery in a categorical skill--in spite of adequate conceptual potential", (Velluntino, Harding, Phillips, Steger, 1975). The prerequisite skill unique to the reading process is the perception of words through "distinctive features" and "higher-order invariants", (Velluntino, 1975). Distinctive features are divided into four classes: semantic, syntactic, phonological, and graphic. Thus, Velluntino's work supports the hypothesis that a perceptual deficit is not the basic deficiency contributing to symbol and sound association problems in poor readers. Instead, the underlying deficit appears to be related to the integration of visual and verbal information. This was the first evidence that dyslexia maybe a deficit in the processing of verbal information.

The dyslexic child's difficulty in integrating information from various sensory systems has also been cited in the research as a primary

deficit area. Studies by Bryden (1972), which implicate deficits in cross-modal transfer (ie. visual to auditory), indicate that poor readers may be less proficient than normal readers in coding information from temporary storage in short-term memory. However, studies that have controlled for possible short-term memory or attention deficits have yielded no differences between poor and normal readers on non-verbal intersensory learning tasks (Steger, et al., 1972; Velluntino, et al., 1973, Velluntino, Harding, Phillips, and Steger, 1975). The findings of these studies do suggest that poor and normal readers were differentiated on cross-modal tasks that included verbal components. Snowling (1980) analyzed the development of grapheme-phoneme conversion between normal readers and reading-age matched dyslexics. Her results indicated that "the use of grapheme-phoneme correspondence increased with the reading age in normal readers, but not in dyslexics", (Snowling, 1980). For the child with dyslexia an increase in reading age is attributable to an increase in the size of their sight vocabulary. The child continues to demonstrate difficulty decoding unfamiliar words into it's sound components. Consideration of Velluntino's and Snowling's research suggests that poor readers do not suffer from a primary deficit in intersensory integration in it's purest form, but may be less proficient in cross-modal tasks that include verbal components.

Research indicates that serial order recall as a possible deficit area has gained the most attention by clinicians and educators. They have observed that dyslexics have difficulty with visual and/or auditory sequencing, and that they demonstrate increased phoneme reversals in their speech (Velluntino, 1979). In addition, dyslexic children have demonstrated sequencing errors in oral and written spelling, and poor readers

differ from normal readers in serial order recall on various types of sensory stimuli, regardless of modality (Velluntino, 1979). This research implies that poor readers have difficulty, specific to serial order recall, and that gross memory skills are intact. However, a major argument is posed by those individuals doing research in this area of "normal" reading development regarding the possible unimportance of serial processing in normal word decoding (Brewer, 1972; Gough, 1972). A definite conclusion may not be made regarding the significance of a serial order deficit demonstrated by the dyslexic child. The question of whether sequential processing of individual letters and letter sounds is the means by which words are identified must be answered first. Better understanding of verbal encoding may answer some questions regarding the role of serial order to this process.

Evidence indicates that dyslexics demonstrate differences from normal readers on underlying processes which are directly or indirectly related to deficits in verbal processing (Denckla, 1979; Velluntino, et al., 1975; Velluntino, 1979). Which aspects of verbal processing are related to deficits in reading ability? The problem is perceived as being related to word decoding (Denckla, 1979; Velluntino, 1979). Assuming that this is true, then the discussion can be narrowed to those areas which may allow or impede word decoding. Visual-verbal association is such an area.

The literature indicates that children with dyslexia have no general learning deficit (Velluntino, et al., 1975; Velluntino, 1979). No difference was found between normal and poor readers on paired-association learning involving non-verbal material. The reverse is true, however, in that learning is hampered when a verbal component is involved in visual-verbal association tasks (Velluntino, et al., 1975). The types of errors

made by the dyslexic group on tasks requiring the association of visual stimuli and nonsense syllables were characterized by actual word substitutions, (e.g. "fog" for "mog"). This type of error may be indicative of a coding system which is semantically based. The dyslexic group was less able to code nonsense words phonetically, demonstrating reduced skill coding the visual and aural (i.e. linguistic) information. Velluntino and his associates created a learning paradigm intended to stimulate the type of generalization learning involved in acquiring skill in reading (e.g. learn, "cat, rat, can" and then decode spontaneously the word "ran") (Velluntino, et al., 1975). Results of this study revealed that children with reading difficulties performed as well as normal readers on visual-verbal association tasks, but performance was reduced for dyslexics on visual-verbal tasks. The reason for this poor performance is unknown. This may be a result of the dyslexics efforts in verbal learning rather than in visual or intersensory (i.e. non-verbal) learning. This dysfunction may be due to a specific difficulty in integrating visual and verbal information. There has been concern expressed regarding possible deficiencies relative to inter- or intra-hemispheric transfer. Some authors argue a deficit in one or more aspects of verbal processing may contribute to the confusion in the detection, and/or application of the phonological, semantic and syntactic features, which thus impairs visual-verbal integration (Velluntino, 1979; Velluntino, et al., 1975; Denckla, 1980). Forness (1982) argues that subtle language deficits may leave the dyslexic child with a reduced ability to "cross reference incoming words in terms of their appearance, pronunciation, function, derivative forms and meanings in various contexts" (Forness, 1982). However, there is little objective evidence to support these contentions.

Primary deficits in processing semantic information interferes with the child's ability to extract meaning from words. Research indicates that dyslexics do demonstrate some degree of difficulty abstracting the meaning from printed words, especially in the comprehension of running text (Denckla, 1979). This difficulty may be due to actual word decoding deficiencies, or deficiencies in processing the meaning of the word, or word retrieval (i.e. memory related) deficits. According to Waller, (as cited in Velluntino, 1979), poor readers are able to gather the general meaning from sentences. Waller analyzed the types of errors committed by normal and dyslexic readers on sentence reading tasks and discovered that dyslexics were less inclined to use a verbal code to retain information. Poor readers had difficulty retaining exact verbal strings and syntactic details (e.g. tense and plurality). Waller hypothesized that this was due to the use of a less efficient visual code. This information implicates the dyslexic child's reduced ability to code information phonetically as a causal factor. Perfetti found that poor readers have difficulty in "naming a word stimulus and in retrieving semantic information in response to a name" (as cited in Velluntino, 1979). Poor readers are less time efficient at getting to the point in the comprehension process where general meaning suffices. They are also poor at retaining exact word meanings. The implication is that semantic decoding is an automatic consequence of phonological decoding. This is not necessarily true, but difficulty in retrieving a category name, because of the difficulty in decoding the word phonologically, may result in a labored processing of the meaning of a word. In summary, research findings suggest that dyslexics do not have a "primary" deficit in semantic processing (i.e. gathering meaning from words and organizing this infor-

mation). However, access to specific meanings is not as efficient due to word encoding or retrieval difficulties, which in turn result in inefficient processing in short-term memory.

A deficit in syntactic ability may also reduce the dyslexic child's ability to efficiently process incoming words in various contexts. Normal development of syntax requires that children learn to employ the rules of syntax and learn the exceptions to those rules. The dyslexic child demonstrates deficits in his ability to use information about grammatical relationships to effect understanding of written language (Velluntino, 1979). Research of normal children's oral syntactic development indicates that those children who were less proficient linguistically were less adequate in their reading ability (Fry, Johnson and Huel, 1970; Vogel, 1974). Analysis of oral language samples obtained from dyslexic groups reveals poor word finding in that ideas were poorly organized and not developed adequately. In addition, oral language was structurally different, in that poor readers typically used phrases related only to the subject (e.g. "this monkey and that monkey and the other monkey are talking"). Oral language samples reflected less flexibility and simplistic syntactic usage. Also, the percentage of incomplete sentences was greater in comparison to that used by normal readers. This illustrates that reading disability and syntactic inadequacy are related. The deficits listed above may impair word recognition and comprehension by limiting the variety of verbal labels available for accessing or acquiring the coded relations involved in learning to read.

The literature reflects a great interest in the relationship between dyslexia and the malfunction of processing phonological components of written words. This interest may be due to the belief that "reading is

the creation of the sound form according to its graphic model" (Russell, 1982). Therefore a prerequisite skill for reading appears to be the link between alphabetic symbols (i.e. graphic), and spoken sounds. This may not always be an easy task because this link is not always a direct one-to-one correlation. Early research by Wepman placed particular emphasis on the ability, or inability, of dyslexics to discriminate sounds auditorily as a prerequisite to word identification (Russell, 1982). Although this theory has been popular throughout the literature, very little evidence is available to support it. On the other hand, Shankweiler and Liberman (1972) have shown that dyslexics "who made errors in reading minimally contrasted pairs (e.g. pen/pin) vocalized these same words with little difficulty when they were presented orally." These findings, contrary to Wepman's theory, suggest that dyslexics do not have any specific auditory discrimination deficit. Researchers such as Liberman, Elkonin, and Mattingly contend that dyslexics have reduced "linguistic awareness" (Liberman, 1974; Elkonin, 1963; Mattingly, 1968). Linguistic awareness is described as one's conscious knowledge of the types and levels of linguistic processes characterizing spoken language. Reading requires knowledge of the phonetic structure of spoken language, before one is able to map alphabetic symbols to sounds. The dyslexic child must be able to understand that a word can be segmented into phonemes and that graphic symbols represent phonemes rather than symbols. A dyslexic child may conceivably be able to discriminate between spoken words such as "pin" and "pen", but have no awareness that each contains three separate units. This reduced linguistic awareness may be the underlying factor most common to dyslexics observed inability to code novel words phonetically. Research findings previously cited by Snowling (1980),

indicate that dyslexics indeed demonstrate deficits in grapheme-phoneme development. Snowling's data suggests that dyslexics are not just like readers at the lower end of the normal distribution of the reading scale. Dyslexics develop strategies to read whole words and thus build a considerable sight vocabulary, but they continue to demonstrate difficulty decoding unfamiliar words. Snowling contends that this deviant grapheme-phoneme correspondence skill is due to a general verbal deficit. The transition of grapheme to phoneme is viewed as a complex task requiring many subskills such as orthographic awareness, phonemic segmentation and verbal memory. Russell's research supports Snowling's work (Russell, 1982). Results from his study reveal that by utilizing a phonetic reading test, which was devised to assess the perception and/or processing of spoken sounds and reduce to a minimum any dependence on the meaning of the words, the severity of the dyslexic's disorder is mirrored even seven years after the original diagnosis. The dyslexic child may implement a phonetic code in processing visual material to some extent, but this code is demonstrated as weak and defective (Velluntino, 1979).

The possibility that poor readers are relatively insensitive to the phonetic structure of both spoken and written language leads to an understanding of their reduced ability to learn and generalize verbal skills dependent on such a sensitivity. This reduced ability is linked to all linguistic processing such that even semantic processing is effected by possible phonetic decoding difficulties.

The literature provides convincing evidence that reading disabilities are the result of reduced skill in one or more aspects of verbal processing. Why then are researchers not directly addressing individual deficits in verbal processing? There are data to indicate that children demonstrating

reading disabilities have now or have had earlier, language disorders (Levi, Capozzi, Fabrizi, Sechi, 1982). What steps should be taken to ensure that these "at risk" language disordered children have the opportunity to transfer spoken language skills into a written form. An argument can be made in favor of delaying teaching the correspondence between grapheme and phoneme until such time that the child has a good command of spoken language. This argument implies that all language disordered children should be monitored in their development of reading skill. This implication is accurate in part, but one must continue to consider the exclusionary criteria previously discussed. The child who is at risk for dyslexia is the child whose difficulty cannot be attributed to any extrinsic factor. Once the dyslexic child is identified, what should remediation address? Given the evidence regarding a deficit in aspects of verbal processing, is it not time to leave behind remediation approaches which emphasize training of perceptual-motor skills? Remediation to date has been oriented toward increasing attention to the alphabetic characters by various techniques such as color coding vowels and consonants or tracing the form repeatedly to achieve discrimination (Benton and Pearl, 1978; Bryant, 1965). The ineffectiveness of such remediation techniques should be apparent when research such as Russell's (1982) revealed the persistence of this disorder. Has remediation addressed the problem? Remediation efforts might be better spent focusing on deficit areas such as phoneme segmentation. Williams (1980) believes in providing the dyslexic child with explicit training in phoneme analysis and blending, letter-sound correspondence and decoding. This method was perceived to increase dyslexics decoding skills for unfamiliar words. The effect of general language enrichment has not been

explored relative to increasing the dyslexic's proficiency in utilizing vocabulary or syntactic structures appropriately. The need for continued research is obvious. Additional information is necessary regarding the etiology of this disorder. The issue of central nervous system involvement surfaces frequently in discussions regarding the etiology of dyslexia. However, little data is available to support this hypothesis. Future research must also address remediation techniques which are based on the hypothesis that dyslexia is a deficit in verbal processing. As Denckla states, "language disorders are not always sufficient to explain dyslexia, but the most universal symptom(s) are verbal learning and verbal behavior" (Denckla, 1979). If this is true, then researchers and practitioners must be urged to shift their efforts toward a better understanding of the relationships between verbal processing (i.e. language processing), and dyslexia. A review of the literature indicates that the majority of research and intervention has been conducted by pediatricians, neurologists, psychologists, and special educators. There is little indication that speech and language pathologists have been involved in working towards a better understanding of this disability. Who is better qualified in the diagnosis and intervention of a language based disorder?

Based on a review of the literature, this writer contends that dyslexia is indeed a language disorder and should be treated by language specialists. Data suggests that the dyslexic child demonstrates deficits in one or more aspects of language (i.e. semantics, syntax, or phonology), and is therefore less efficient in integrating the visual and verbal information at the higher levels of language processing. Furthermore, this writer argues that the dyslexic must develop these basic components of language before successful integration can occur. The speech and language path-

ologist should be responsible for providing an in depth assessment of the child's individual language needs and then provide the necessary treatment. It is surprising to this author that the value of direct language therapy or even general language enrichment programs has not been discussed in the literature. Again, this writer argues that it is the responsibility of the speech and language pathologist to begin to build evidence in support of such intervention strategies. Furthermore, the speech and language pathologist should take the initiative to educate those special educators and related professionals in constant contact with the dyslexic child. In services and educational programs which emphasize the importance of language processing to the dyslexic's development of reading skill can only aid in providing these children with an effective, comprehensive treatment program.

Much is still unknown about the disorder of dyslexia, but there exists data throughout the literature which suggests that this disorder is a deficit in verbal processing. The literature also suggests that treatment strategies have not been effective to date (Russell, 1982), thus strengthening the argument in favor of intervention by speech and language pathologists.

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