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ABSTRACT

This report was prepared to provide recommendations for testing adult dyslexics for employment purposes. Since the literature on dyslexia does not deal directly with this topic, the recommendations are based primarily on inferences from what is known about the diagnosis, etiology and treatment of dyslexia in children. A summary of the major findings and issues is provided. In light of the indirect nature of the evidence, the recommendations for testing adult dyslexics should be considered carefully and followed with caution. (Author)

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**United States
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Technical Memorandum 76-4

TESTING THE HANDICAPPED FOR EMPLOYMENT PURPOSES: ADAPTATIONS
FOR PERSONS WITH DYSLEXIA

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March 1976

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ABSTRACT

This report was prepared to provide recommendations for testing adult dyslexics for employment purposes. Since the literature on dyslexia does not deal directly with this topic, the recommendations are based primarily on inferences from what is known about the diagnosis, etiology and treatment of dyslexia in children. A summary of the major findings and issues is provided. In light of the indirect nature of the evidence, the recommendations for testing adult dyslexics should be considered carefully and followed with caution.

PREFACE

This report was intended to be a background report from which a policy for the employment testing of adults with dyslexia could be developed. However, the author found little in the literature which would lend itself to the development of such a policy. Therefore, the recommendations made should be followed with caution.

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This is one of a series of reports concerned with special adaptations of written tests for measuring the cognitive abilities of disabled applicants for employment. It summarizes and analyzes the major literature on dyslexia, a form of reading disability, and presents recommendations regarding the type of test adaptations that might be warranted for applicants with this disability. Although the literature dealing with dyslexia is considerable, relatively few studies are based on solid statistical and objective methods. More often than not the studies are anecdotal and are based on observational evidence available through the clinical practices of particular researchers. Consequently, the samples tend to be small and unrepresentative of the total population of dyslexics and are frequently unmatched with an adequate control group of nondyslexics. As this report will show, the lack of agreement about the nature and diagnosis of dyslexia is partly responsible for the piecemeal nature of the research in the area. This report will limit itself to summarizing and reviewing only the more substantive and sound research findings about dyslexia. Unfortunately, very little is known about dyslexia, especially in adults; therefore the recommendations given in this report must be very carefully considered by the employer before being implemented in an examination program.

There is no doubt that reading with understanding is a complicated procedure that involves, among other things, the capacity to perceive and recognize symbols and the ability to integrate them into a meaningful sequence. Difficulty in any one or more of the component skills diminishes a person's facility with written materials. Because of the complexity of the reading process and the many factors that contribute to and affect the process, there is an almost infinite variety of reading disabilities. The classification of these disabilities has not been an easy task, variously being based on patterns of symptoms, etiology (cause) or treatment. It is within this context that the specific disability of dyslexia can be found.

Although *dyslexia*, as first defined in the late 1800s, was intended to describe a particular form of reading disability, the term has been used rather loosely and at times has come to signify nearly any kind of reading disability. This state of affairs has prompted more than a few researchers to suggest that the use of the term be discontinued. Unfortunately, following their own directives, researchers have created numerous additional terms and qualifiers to fill the void, all more or less reflecting the particular author's views about the disability. The current trend seems to be to continue the use of the term but to clarify its meaning in each particular instance. However, the reader is advised that such terms as *specific language disability*, *specific reading disability*, *word blindness* and *strephosymbolia* (literally "inverted symbols") are frequently used to refer to the same disability. Similarly, the term *dyslexia* is often qualified with such modifiers as *developmental*, *primary*, *dysphonic* or *dyseidetic* to reflect the belief of some researchers (e.g., Rosenthal, 1973) that there are distinctly different types of dyslexia.

This report will adhere to current practice and advance an initial general definition of the term *dyslexia*, to be modified and qualified by subsequent discussions. Generally, dyslexia refers to a specific reading disability that cannot be attributed to brain damage, low levels of general intelligence, sensorimotor deficiencies, inadequate education or psychosocial disturbance. (Although dyslexia is not attributable to brain damage per se, this report will show that there may be other physiological bases for the disorder.) More specifically, individuals with dyslexia have difficulty maintaining the proper sequence of letters and words while they are reading. For example, the word *London* may be perceived as *Idonno*, *Dnonol* or possibly *Nodleno*. The letters and words are perceived in the wrong order, sometimes with added components but at other times with gross deletions, merges, rotations, misalignments and reversals which are inevitably reflected in the dyslexic's spelling (Clarke, 1973). Examples of spelling errors typically made by

dyslexics are: *was* for *saw*, *no* for *on*, *supr* for *supper* and *weit* for *white*. The letters *p*, *b*, *d* and *q* are particularly troublesome for dyslexics and are frequently reversed or disoriented. Aside from the spelling and related grammatical errors, the spontaneous writing of the dyslexic is frequently characterized by poor penmanship. Letters are poorly or incorrectly formed and often illegible. Even speech is affected by the disability. Dyslexics show a higher incidence of persistent mispronunciation (usually reversals, e.g., *preform* instead of *perform*), malapropisms (misuse of words), spoonerisms (slips of the tongue whereby sounds of words are accidentally combined or transposed), and double-talk, compared to the incidence of these behaviors in nondyslexics.

Considering the similarity of these characteristics to those of other reading problems (as well as to the problems encountered during the normal acquisition of reading), it is easy to see why it has been so difficult to clarify the concept of dyslexia. It should also be recognized from the previous list of characteristics that although dyslexia means a deficiency in reading, it seldom occurs without evidence of other deviations, some of which are specifically related to the deficiency, while others are due to its effects or to secondary causes (Duane, 1974). Particularly prominent among the latter effects are the psychosocial consequences of the reading deficiency on the individual. Often the failure in reading and the humiliation associated with such failure lead to a dislike and avoidance of the reading situation, which further aggravates an already critical situation and further obscures the original causes of the reading deficiency.

Finally, it must be emphasized that the symptom patterns of dyslexia are extremely variable, ranging from no reading ability to nearly normal reading ability. Furthermore, the equally considerable variability in reading performance *within* individual dyslexics makes it imperative that test scores based on reading performance be interpreted with caution.

Incidence of Dyslexia and Problems Associated with its Measurement

Given the ambiguity of the definition of dyslexia and the inevitable classification

problems that result from such ambiguity, it is not surprising that estimates of the occurrence of dyslexia in the general population vary from 2 percent to as high as 25 percent. The most reliable estimates place the figure at about 10 percent, with 2-3 percent designated for the most profound cases (Jani, 1973). This incidence rate compares to those of other childhood handicaps as follows: visual impairment, .3 percent; epilepsy, 2 percent; mental retardation, 3 percent; hearing impairment, 3-5 percent; and speech and hearing impairment, at least 5.4 percent. The incidence rate of reading problems resulting from any cause is generally placed at about 15 percent (Thompson, 1966). By these comparisons dyslexics represent a sizeable segment of the school-age population in the United States, a segment which is mostly subsumed under the larger category of "bad readers."

The incidence rates of reading disabilities, and that of dyslexia in particular, are considered by many to be conservative and to underestimate the magnitude of the problem. It would be useful if an up-to-date and precise survey were conducted so that the magnitude of the problem could be more accurately assessed. Part of the difficulty in assessing the incidence of dyslexia lies in the general lack of awareness about the disorder. For example, it was not until 1964 that the Council for Exceptional Children of the National Education Association recognized "specific language disability" (dyslexia) as an area of exceptionality. Myths about dyslexia present another difficulty in assessing the incidence of dyslexia. It is not uncommon for even well-educated individuals to say, "Anyone can learn to read if they would only try," or "Only the feeble-minded cannot read." Such careless equating of reading disability with low intelligence has forced many dyslexics of average or superior intelligence to go through life stigmatized with such labels as "retarded" or "dull." If intellectual deficiency is not blamed, educational deficiencies or psychological disturbances are readily cited.

Just as dyslexia is not to be equated with low intelligence, educational deficiencies or psychological disturbance, neither is it to be equated with irreversible or gross brain damage. Although neurophysiological deficiencies, neurochemical disorders, accidents and trauma can cause reading loss, it is inaccurate to argue that

all reading loss is the result of some irreversible kind of brain dysfunction. Such arguments have enveloped dyslexia in an atmosphere of hopelessness and unspeakable dread, when in fact most dyslexics can learn to read after proper remediation and can come to lead normal, productive lives.

Most definitions expressly disassociate dyslexia from such causative factors; yet the myths persist, and many dyslexics spend their lives covering up their disability. Such behavior makes it difficult to obtain reliable incidence data, particularly at the adult level. Consequently, there has been no systematic attempt to determine the incidence rate of dyslexia among adults. The rate appears to be less than the 10 percent cited earlier, but it is not clear whether the dyslexia has been outgrown or the individual has merely learned to work around his or her handicap.

Diagnostic Characteristics and Hypotheses About the Etiology of Dyslexia

Major Diagnostic Characteristics of Dyslexia

There are virtually no studies about adult dyslexics to be found in the literature and nearly all research concerns have been directed toward the child and the educational process. Particularly relevant in this regard is Satz and Van Nostrand's (1971) observation that the nature of dyslexia varies largely as a function of chronological age. They suggest that dyslexia differentially delays certain reading skills that become preeminent at different developmental stages of childhood. It should therefore be borne in mind throughout the following discussion that generalizations to adults must be made with great caution.

It was indicated earlier that the most prominent characteristic of dyslexia is the inability to process letters in their proper sequence during reading. It should also be noted that the disability is not necessarily limited to letters and can involve other symbol systems, such as those of mathematics and music. The sequencing disability seems to be central to dyslexia. Goldberg and Schiffman (1972) report significant relationships between visual perception, visual memory and visual sequencing on the one hand, and reading achievement on the other. Miles and Wheeler (1974) found

that dyslexic children are unable to retain complex information over time. In the process of concentrating on complex information, its sequence in a series is lost and earlier information fades before later information can be absorbed and understood in its proper context. In other studies, Stanley and Hall (1973) observed significant differences between dyslexics and nondyslexics in the early stages of visual information processing, while Zurif and Carson (1970) reported that dyslexics scored significantly lower than nondyslexics on tasks dealing with the temporal aspects of non-verbal auditory and visual information. Closely related to these findings are the observations that some dyslexics, despite conventional training, persist in confusing such temporal and spatial opposites as *tomorrow* and *yesterday*, *left* and *right*, *up* and *down*.

Although the difficulties in sequential processing are typically attributed to deficiencies in central processing capabilities, researchers have found higher percentages of deficiencies in fusional eye movements, tracking, and visual discrimination among dyslexics than nondyslexics. (e.g., Klasen, 1972; Friedman, 1974). Findings such as these call for reexamination of the blanket statement that excludes from the definition of dyslexia all reading disabilities stemming from peripheral sensory deficiencies. Certain peripheral dysfunctions may actually be useful diagnostic characteristics of dyslexia. Further research is needed to determine the extent to which such peripheral deficiencies are primary causal factors of dyslexia. It is entirely possible that the findings can be attributed solely to the greater salience of peripheral defects among dyslexics.

Although dyslexia is most frequently associated with defects in visual processing, auditory processing may also be disturbed. Many spelling errors made by dyslexics are homonyms or phonetic equivalents, such as *kof* or *cof* for *cough*. The prominence of such errors has led some researchers to propose three subtypes of dyslexia: dysphonic dyslexia, revealing a primary deficit in letter-sound integration; dyseidetic dyslexia, revealing a primary deficit in the ability to perceive whole words as visual gestures; and a mixture of the two basic types (Boder, 1973). (Although the classification of dyslexia into subtypes appears to be meaningful and useful, some researchers,

e.g., Naido, 1972, do not agree that the data support such a classification; the issue seems to be rather academic, however, and largely a matter of a difference in emphasis.)

In the case of individuals with dysphonic dyslexia, the phonetic sequence of speech sounds seems to be distorted in a manner similar to the way in which letters are improperly sequenced during reading. Although the individual sounds are heard with good acuity, the louder units of speech may be perceived out of order and before the quieter ones, making interpretation of speech difficult (Roberts, Simon and Thomas, 1972). A direct consequence of such mishearing is the persistent mispronunciation of certain words. Of course, misreading words that are not heard leads to similar pronunciation errors. Dyslexics who are aware of their speech errors frequently refrain from using the "problem words" in their conversation, with the result that their reading and writing vocabulary may differ considerably from their speech vocabulary.

Although many dyslexics experience no difficulty in writing, most are handicapped by poor penmanship. The *i*'s tend to go undotted, *m*'s and *r*'s are poorly formed, the lower part of the *f* is reversed, the same peculiar symbol is used for *h* and *k*, and so on (McClelland, 1974). With training, many dyslexics learn to write fairly legibly, but their fine motor coordination remains below normal levels and their writing seldom becomes good (Thompson, 1966).

Cerebral Dominance, Handedness and Dyslexia

Due to left-right crossing of the neural pathways, the two cerebral hemispheres of the human brain control sensorimotor functions on opposite sides of the body. However, the hemispheric controls are seldom equivalent, and it is not uncommon for certain functions to be performed better and more often on one side of the body than the other. A common example of such a preference is the phenomenon of handedness. Traditionally, it was thought that a person who was right-handed had a dominant left cerebral hemisphere and would show similar preferences for other right-sided functions. However, laterality of functions does not always follow such a consistent pattern. Many persons have mixed preferences, such as kicking with the left foot but writing

with the right hand. Not even handedness is a true dichotomy, for it is possible to find a particular hand preference for fine motor coordination and the opposite hand preference for behaviors requiring gross hand movements. Laterality and cerebral dominance occur on continua, and there are probably very few cases of pure cerebral dominance or laterality for sensorimotor functions (Orlando, 1972).

The issue of cerebral dominance is mentioned here because left-handedness (as well as mixed laterality and dominance) has been discussed as a correlate of dyslexia for many years. Clinical observations have indicated a higher incidence of left-handedness, mixed, or confused laterality among dyslexics than in the general population; and if the deviation from "pure" right-handedness was not observed in dyslexics themselves, it could usually be observed in their family genealogy.

The relatively more controlled and sophisticated studies of cerebral dominance and dyslexia have greatly reduced the emphasis placed on this relationship. Nevertheless, there remains a general consensus that there is a slight positive correlation between cerebral dominance and dyslexia, and that both phenomena are most probably corollary manifestations of other factors. However, dominance in itself cannot be considered a significant diagnostic characteristic, since more than two-thirds of the dyslexics do not manifest dominance problems, and two-thirds of the individuals with atypical dominance are not dyslexic (Notz, 1971).

Nevertheless, research on dominance continues, and researchers show considerable disagreement about which kind of laterality is most significantly predictive of dyslexia. Critchley (1964) emphasized mixed dominance, while Bakker (1973) found a positive relationship between reading ability and ear dominance. Finally, two types of dyslexia, dysphonic and dyseidetic, may be the effect of sequencing deficiencies in the verbal and visual hemispheres, respectively. More extensive and well-controlled experiments are likely to add significantly to the understanding of the relationship between dyslexia and cerebral dominance.

Heredity and Dyslexia

In the previous section the possible hereditary bases of dyslexia were suggested by the incidence of atypical dominance in family genealogy. Geneticists, however, have tended to shun the study of dyslexia, since it lacks the precise definitions and diagnostic indicators with which they prefer to work. Nevertheless, evidence for a genetic etiology increases (Rosenthal, 1973; Sladen, 1972). Herman (1959), in a study of 45 sets of twins with reading disabilities, found that in the 12 pairs of identical twins (monozygotic) both individuals manifested identical reading disabilities. This 100 percent concordance figure compares to only 33 percent concordance for the 33 remaining fraternal (dizygotic) twin pairs in the study. Studies such as these are supported by numerous clinical observations that the incidence of reading disability tends to run in families (Critchley, 1963).

Additional evidence for the genetic theory is the persistence of dyslexia despite treatment. Disabilities due to environmental or external effects usually disappear with time or treatment, but dyslexia remains. This is not to say that dyslexics do not improve in their general functioning. On the contrary, appropriate treatments that rearrange the environment and allow dyslexics to work around their disabilities have been quite successful. Yet it must be noted that such compensation or adaptation around the handicap does not mean that the specific original deficiency has been eliminated. The basic processing deficiency that results in dyslexia is not easily outgrown.

On the basis of findings by 15 researchers, Critchley 1964 was able to calculate an average ratio of 4 to 1 (male to female dyslexics), suggesting not only that dyslexia has a genetic basis but also that it may be a sex-influenced trait. Although there is considerable variation in the estimates of this ratio, it is agreed that there is a sex difference, despite the absence of any sound explanation for the phenomenon. It may be that, thus far, dyslexia has been considered to be a more serious handicap for males than females, resulting in differential rates of report. Another possibility is that females may be dealing more effectively with their handicap--and at an earlier age--due to their relatively greater maturity, especially in language-related

skills.

In opposition to the idea of a genetic origin is the fact that no chromosomal, chemical, or other definitive proof has yet been put forward to support the theory. It is also agreed that gross differences in the incidence of dyslexia across countries suggest that dyslexia is a cultural-experiential, rather than an inherited, phenomenon. This latter argument, however, is not conclusive, since there are numerous ways in which identical incidence rates in different countries can become disparate. First, there may be cultural variations in the willingness to report a reading disability. Second, there may be large discrepancies in the ways dyslexia is defined and diagnosed in different cultures. Third, phonetic and linguistic differences between the languages may differentially precipitate dyslexia. Organized, logical and systematic languages do not generally present as many problems for the dyslexic as irregular languages such as English. This principle is taken advantage of by therapies in which the study of Latin or rigorous linguistic drills are recommended. Finally, the methods of reading used in different cultures may differentially precipitate reading problems. Reading therapists generally consider the sight method of reading to be more difficult for the dyslexic than the phonic method, in which each word is formed by merging the sounds of the individual letters or groups of letters.

Despite arguments to the contrary, efforts to demonstrate a genetic basis for dyslexia persist and seem to be gaining support (Leong, 1972). More recent efforts have focused on hormones, neurochemicals and brain waves as possible fundamental indicators of dyslexia. However, no substantive conclusions can be drawn at this time.

Maturational Lag and Dyslexia

The theories about the etiology or cause of dyslexia are as varied as its symptoms, there being a theory for nearly every characteristic that shows some promise of distinguishing between dyslexics and nondyslexics. Various viewpoints have already been described in earlier sections of this report. One theory which has not thus far been mentioned, despite its increased popularity in the literature, is the notion of developmental or maturational lag.

In this view, dyslexia is seen not so much as a loss of something, but rather as a failure to outgrow certain childhood behaviors (Critchley, 1970; Thompson, 1973). This position raises many questions. If dyslexia is due to a peculiar type of immaturity, might not reading achievement improve naturally with age, as it does for most people? Is the fact that dyslexia is so rarely diagnosed in adults due to dyslexics maturing out of their handicap, adjusting to it, hiding from it, or simply resigning themselves to hopeless ineducability? To date, there is little evidence to support the theory, and most of the questions it raises have not been adequately answered. It is clear, however, that dyslexics in many ways resemble nondyslexics when they first learn to read; however the latter group progresses, while the dyslexics lag behind.

Some Secondary Effects of Dyslexia

Finally, a few words must be said about psychopathological correlates of dyslexia. Dyslexia is seldom an isolated phenomenon; it is usually accompanied by complications that affect the whole person. The dyslexic, if not identified early, gets caught in a vicious circle leading from reading disability to behavior problem and from behavior problem to increased reading disability. The origin of the circle is difficult to identify, but most researchers would agree that psychopathological phenomena are both a consequence of dyslexia and a source of subsequent aggravation of the condition.

Some of the psychopathological symptoms accompanying dyslexia include anxiety, poor concentration, immaturity and a low frustration tolerance. These are typical symptoms of stress-producing situations that can, regardless of their origin, interfere with the normal acquisition of reading skills. Goldberg and Schiffman (1972) have generalized about the experiences of children who are beset with problems of this nature and who have had no therapeutic treatment. First, there is a "could not care less" attitude as the child begins to fail in school. Second, the child comes to attribute his or her failures to the teacher and the school, and when that transference fails, it is often followed by a stage characterized by feelings of marked inferiority. The dyslexic begins to be-

lieve that all the problems are his or her fault and that he or she really must be stupid or lazy. Finally, the loss of self-esteem gives way to frustration, and the dyslexic emotionally blocks out all possible reading experiences. During this time truancy, hostility and destructive behaviors are common, and the child may eventually drop out of school entirely. Studies by Hogensen (1974) suggest that reading disability is perhaps the single most important precipitating factor of delinquency. This is not to imply that all delinquents are dyslexics, or vice versa.

Although some individuals with reading problems have made remarkable progress through psychotherapy alone, the majority of cases show very little improvement unless the psychotherapy is accompanied by reading remediation. Only in severe cases of psychological blocking should psychotherapy alone be prescribed, and even then, reading therapy should start at the earliest possible time. The psychological symptoms of dyslexia are reactionary and usually benign when treated; it is when they go untreated that all the damage is done (Critchley, 1970).

Thus, dyslexia presents a tremendously complicated picture in which few of the features are distinct. From the nature of the symptoms, it is easy to see how such a large number of terms and definitions about this reading problem originated. It is also clear that the symptoms of dyslexia are not uncommon; many nondyslexics, when learning to read, manifest some of the same symptoms, although usually not as many and not for as long a time. This overlap of symptoms between dyslexics and nondyslexics helps explain why so many parents of dyslexics delay getting help and why so many well-meaning professionals delay treatment, thinking the child will "outgrow it." Most children do, but for the dyslexic the symptoms tend to linger on.

Diagnostic Approaches and Tests for Dyslexia

Considering the diverse manifestations of dyslexia and the extent to which it may be affected by secondary environmental and psychological factors, it is no wonder that the task of diagnosis has not been easy. The most widely used diagnostic approach is diagnosis by exclusion. It relies on ruling out other explanations of an individual's

inability to read, such as mental retardation, gross defects in vision and hearing, speech impairment, emotional disorder, bilingualism, sociocultural disadvantage and poor or insufficient instruction (Boder, 1973). Although this approach has been useful, it has the disadvantage of excluding from diagnostic consideration the crucial fact that dyslexia may coexist with any one or a combination of contributing factors.

Most efforts to develop diagnostic instruments have focused on elementary school pupils, with whom remedial programs are most effective. Diagnosis at this level usually involves tests of general intelligence, such as the Wechsler Intelligence Scale for Children (WISC), in which subtest scores of abilities can be compared for discrepancies with academic performance. Reading tests and readiness tests, such as the Metropolitan Reading Test, are also frequently used, often in conjunction with intelligence tests. Comparisons are then made between an individual's performance on the reading and intelligence tests, enabling the diagnostician to distinguish between handicapped readers who appear to be deficient in intelligence and those who demonstrate adequate general cognitive functioning.

Electroencephalograms, brain scans and various other medical tests are used to identify individuals whose reading difficulties stem from neurophysiological dysfunction. In addition, the Bender Visual-Motor Gestalt Test and the Good-enough Draw-a-Person Test are two paper-and-pencil tests that have demonstrated some success in this diagnosis. In order to check for the possibility that a reading problem may stem from sensory deficiencies, routine visual and hearing tests are included as integral parts of most diagnostic batteries. Finally, a battery for the diagnosis of a reading problem usually includes several measures of psychological and emotional health. These measures help to identify cases in which the reading problem is a secondary reactionary symptom of a psychological disturbance.

Regardless of which tests are used in the diagnosis, it is essential that the testing conditions be carefully controlled, preferably by a psychologist or other professional trained in testing. This individual will have been trained to be

sensitive to the various motivational levels of the subject during testing and to interpret the results in light of what is known about the reliability and validity of each test.

Dannenhower (1972) describes a test for dyslexia that appears to show some promise as a diagnostic instrument, especially for adults. This is the French-Orton Association Test, and it allows for direct diagnosis through analysis of an individual's reading and spelling performance. It does not require the usual estimates of general intelligence, brain functioning or psychological health. Instead, it presents six situations in which dyslexics are most prone to make mistakes. In the first situation the subject is required to echo each of twelve nonsense words, ranging in complexity from *tid* to *gulproletolsis*, that are read by the examiner at a conversational speed. In the second situation the task is similar, except that the subject faces away from the examiner, and is thereby prevented from obtaining facial cues. In the third part the subject is required to spell, without repeating vocally, nonsense words dictated by the examiner. In the fourth section of the test the subject must repeat out loud individual words dictated by the examiner and then say each word again while writing it. The fifth situation requires the subject to write nonsense words that are presented visually at the rate of one syllable per second. Finally, the subject must read aloud a series of visually presented nonsense words. A simple scoring procedure based on the number and kinds of errors is used. Although the test has not yet been standardized, it has been used successfully by reading specialists for several years, and Dannenhower asserts that the various parts of the test are difficult enough for dyslexics so that the presence or absence of the disability in a subject can be confidently established.

Prognosis and Remediation

At one time it was erroneously but widely believed that dyslexics were totally incapable of learning to read (Critchley, 1970). In fact it is quite possible for children with dyslexia to obtain a practical reading facility as they grow older. Even without special tutoring, many find avenues of approach to reading through recognition of key words and through nonvisual sensory modalities such that they become moderately

proficient in silent reading. However, difficulties in reading aloud, poor writing, mispronunciations and the characteristic spelling errors tend to persist as tell-tale evidence of the problem (Thompson, 1966).

Special tutoring can significantly enhance the likelihood of successful remediation of a reading disability, however the degree of success is highly correlated with the age at which the training is begun. Based on a study of 10,000 cases, Schiffman and Clemens (1966) showed that, with proper diagnosis and training, a successful remediation rate of 82 percent could be secured among second graders, this rate dropping rapidly to 46 percent and 42 percent in the third and fourth grades, respectively. In the ninth grade the success rate was down to 6 percent. It should be noted that nondyslexic reading disabilities were included in the sample, and therefore remediation may have simply resulted from spontaneous recovery of the less severe disabilities at the earlier ages. Without an appropriate control group, it is impossible to assess the extent to which such gains are the result of remediation. Nevertheless, such gains are typical of those found in clinical practice, with the success rate inversely correlated with the age at which remediation for dyslexia began.

Ansara (1972) describes a typical program of language therapy designed to salvage the college potential of dyslexic adolescents. The therapy deals first with the adolescents' need to perform in academic courses. This involves teaching such matters as notetaking, outlining and the use of glossaries, indexes and appendixes. Second, the adolescents are helped with their language problems. The use of a pencil for following along with written material is recommended. This is to facilitate coordination between the eye and the brain, maintain focus and prevent reversals, transpositions and regressions. Tracing initial letters of words has also been shown to be effective. Finally, the program attempts to provide the adolescents with experiences that will enable them to formulate grammatical and orthographical (spelling) rules rather than giving them rules to be memorized.

This is by no means the only program for remediation that has been advanced. It would be unreasonable to expect a

single best method. Critchley (1970) has outlined some of the more important pedagogic procedures, including the recommendations that:

1. The "look and say" method of reading should be replaced by a more phonic or analytic-synthetic system in the case of dyslexics.
2. The progression from simple tasks to more complex ones should be made slowly and gradually.
3. Visual learning should be reinforced through other sense modalities. Thus the dyslexic child should be taught the appearance of a letter (or word), as well as taught to say the symbol aloud, to trace its outline digitally and to write it down.
4. The reading material chosen for learning purposes should be interesting and exciting for the young reader.
5. As a means of ancillary play therapy, toys incorporating letters and words should be encouraged.
6. The teaching should be individualized and intense.
7. The readers may employ various aids, such as markers or even their own fingertips, to help them keep their place in a printed text.

Various "reading machines," tape recorders and phonograph records frequently find a place in remediation programs. Although elaborate "talking typewriters" have been developed, even a simple typewriter is of service to the dyslexic in that it provides clear visual images of the correct appearance of each letter and word. Presenting written materials in large type may facilitate reading for some dyslexics, but others find it easier to read in smaller type. Possibly the smaller print, since it allows more letters and words on a line, requires fewer eye movements.

Finally, the personal adjustment of dyslexics must be adequate. It is important to provide them with a relaxed atmosphere in which they can feel important and wanted. Encouraging dyslexics and providing them with moral support can go a long way in fostering a healthy attitude toward school and the reading process.

There are few follow-up studies of dyslexic adults, and those that have been performed are largely anecdotal. One of the more thorough, and admittedly more optimistic, studies was conducted by Rawson (1968). Based on a sample of 20 dyslexic boys from a private school with a remedial reading program, Rawson found that two of the subjects had become doctors, two college professors, one a lawyer, two research scientists, three owners of medium-sized businesses, three middle managers, one a school principal, three secondary school teachers, one an actor, one a factory foreman, and one a skilled laborer. This is not to say that all dyslexics can expect such dramatic achievements, but it does point out some of the possibilities, given adequate levels of intelligence and motivation.

Further evidence of the capabilities of "ex-dyslexics" can be found in the frequently referenced list of conspicuously successful ex-dyslexics. This list includes such prominent figures as Thomas Edison, Auguste Rodin, Harvey Cushing, George Patton, Woodrow Wilson, Lawrence Lowell, William James and Albert Einstein (Thompson, 1966).

Critchley (1973) writes that ex-dyslexics, despite their accomplishments, are not without their problems which, though unobtrusive, are nonetheless important and enduring. Although there are exceptions, in general ex-dyslexics are slow and reluctant readers. Literary work does not come easily for them. They may be slow in getting the gist of a document or identifying the main point of a written argument. They are likely to be inaccurate readers, and this may betray itself in their conversation. For example, they may consistently mispronounce certain words which are familiar from their reading, but which they do not associate with their spoken equivalents. Finally, they tend to be reluctant writers. Their writing may be slow and difficult to read, and their spelling is likely to be inaccurate.

Testing Adults for Dyslexia

As mentioned earlier, there are few reported studies of dyslexia in adults. Likewise, no reports on the subject of testing adult dyslexics for employment purposes were found. There are three

possible reasons for this.

First, dyslexia may not constitute a barrier to employment for adults. As indicated earlier, the incidence of dyslexia seems to drop off very sharply with maturation. It seems that dyslexics are for the most part destined to learn to live with their handicap. When the diagnosis is late or nonexistent, the adjustment may involve truancy and delinquency, and the dyslexic's career may very likely culminate in an occupational role requiring little or no complex reading. Those who avoid this path through intelligence, motivation, perseverance and remediation may remain in the educational system through ingenious adaptations around their reading handicap. Such individuals often develop intricate disguises for their handicap and are among the last to publicize their handicap, least of all to a potential employer. This group, some of whom possess high intelligence and motivation, are not likely to ever be known as dyslexics as long as so many myths about dyslexia prevail. Some of these individuals might be our Ph.D.'s with the "impossible" handwriting or our M.D.'s with the atrocious spelling. Others reveal their handicap only when they have to read aloud or in their persistent mispronunciation of certain words. Spoonerisms, double-talk, malapropisms and Freudian slips may be other vestiges of remediated dyslexia. Since many of these remnants occur as variations of normal behavior, their true origins are usually obscured.

Second, funds for reading research are almost exclusively designated for areas with high potential payoffs. Such payoffs are clearly in the areas of diagnosis and remediation during the early childhood years.

Finally, dyslexics have not organized themselves to protest possible job discrimination, and employers are hardly aware of their obligations to hire persons with such a handicap. Many employers may not even be aware of the disorder. The possibility of job discrimination stems from the fact that there are dyslexics who can function effectively in complex job situations that require considerable cognitive skills, but in which the reading of complex written materials is not excessive. Furthermore, some dyslexics have learned to handle complex written material in spite of their problem, e.g., Woodrow Wilson and William James.

All three of these factors probably contribute to the paucity of information about dyslexic adults. Certainly the third could be argued well in light of the progress against job discrimination that has been made by individuals with other disabling conditions. Prelingually deaf employees, for example, often have lower than normal verbal skills, yet their other cognitive skills range across the ability continuum such that many are functioning effectively in the computer sciences, accounting or auditing fields, where mathematical skills are desirable. Blind employees have similarly demonstrated their capability to perform many of the same jobs that are performed by seeing employees.

Unfortunately, the medium--reading--through which such handicapped individuals are usually tested for selection can severely distort or prevent the assessment of the cognitive abilities required for the job. Consequently, the U.S. Civil Service Commission now provides some tests specifically adapted for handicapped applicants. For the blind and partially sighted, the tests are administered in several media: in braille, on cassette tapes, by a reader and in large- and standard-size print. Each medium has its own modified time limits. Any unnecessary use of figural materials is eliminated, just as unnecessarily complex verbal material is minimized for the deaf. It would appear that similar modifications of tests of cognitive ability might be in order for persons with more pronounced levels of dyslexia.

Since most dyslexics applying for employment are likely to be those who have sufficiently adapted to their handicap to remain within the educational system, the modifications can be minor. When the test is a power test, one such modification might be to provide liberal time limits so that the dyslexic will have adequate time to attempt every test item. Of course this modification would be inappropriate for a speeded test. Individualized or small-group testing would be particularly useful in dispelling the excessive anxieties dyslexics have built up about tests over the years. The Educational Testing Service uses similar procedures to administer the Scholastic Aptitude Test to dyslexics and other handicapped persons.

Considering the capabilities and limitations of dyslexics, it would seem reasonable

to modify those written or verbal components of a test or test item that are unnecessary for the evaluation of the ability being measured. Such modifications might include making substitutions for item types, words, letters and spatiotemporal concepts that are particularly troublesome for dyslexics. However, the author does not recommend deleting test material that measures an ability required of regular competitors, unless such a deletion can be shown to be clearly warranted by carefully conducted validity research. Since persons with dyslexia primarily have difficulty in grasping the meaning of printed materials by reading, their performance can be significantly enhanced if materials are presented aurally, using a reader or tape recording. Some dyslexics have learned to use braille, while others have improved their reading by using a marker or tracing key letters of words. A large-print version of the test might be particularly useful for this latter group. All of these modifications, however, entail some expense. Employers may well be justified in not making any changes in their testing programs until more is known about the actual functioning and incidence of dyslexia.

The similarity of dyslexia's symptoms to normal behavior raises the possibility that nondyslexics may request untimed testing on the basis of a self-diagnosis. (It is unlikely that the request of a nonhandicapped applicant for special testing would involve either braille or an auditory version of the test, because these media require experiences and skills that typically are not developed in nondyslexics.) The obvious remedy for such possible abuse of the system is to require formal confirmation of the existence of the disability to a substantial degree. Such proof should normally come in the form of a signed statement on letterhead by a professional who is qualified to make a diagnosis. Professionals most likely to have such qualifications are physicians, psychiatrists, psychologists, certain counselors and reading specialists.

One final note is warranted. Regardless of which special testing procedures are agreed upon, it remains the examiner's responsibility to insure that the applicant's abilities for the job are assessed in the fairest way possible. This calls for an appreciation of each individual case, an understanding of the various manifestations of dyslexia and the flexibility to adjust

the testing procedure to the individual's needs.

Conclusion

This report has summarized the more substantive and reliable research concerning a poorly understood disability. It is clear that dyslexia is a multivariate problem whose description and etiology have yet to be crystalized. Yet, as erroneous conceptions gradually fall away, dyslexia is slowly being recognized as a significant social problem. A heightened public awareness, as well as earlier diagnosis and treatment of dyslexia, will do much to increase the number of dyslexics who complete their education and apply for jobs. There is presently no way of knowing how many dyslexics hide their handicap rather than face the risks associated with detection. Unfortunately, these individuals, some with high intelligence, may be burdening themselves with a handicap that unfairly rejects them from contention for jobs in which selection is to a great extent based on a written test score.

The evidence is clear that dyslexia is not a total inability to read; many dyslexics adapt to their handicap and lead productive lives. Such factors as intelligence, strength of motivation, ingenuity, creativity and self-esteem account for as much variation in achievement among dyslexics as among nondyslexics. Lloyd Thompson (1966), a leading specialist in this area, considers it unfortunate that dyslexia tends to be so readily equated with irreversible brain damage or retardation. Other specific disorders, such as color deficiency or tone deafness, seldom suffer such associations, while certain inherited facilities, such as eidetic imagery or mathematical genius, are explicitly considered "gifts of nature," not brain damage. Dyslexia involves no more brain damage than do these other deviations from normal neurophysiological functioning. Symmes (1972), in fact, suggests that the reading difficulties of the dyslexic may actually be due to a certain spatial facility rather than a weakness. According to this hypothesis, the *p*, *d*, *q* and *b* are confused by dyslexics because they are perceived to represent different orientations of the same three-dimensional symbol rather than four different two-dimensional symbols.

Regardless of the specific symptoms or etiology of dyslexia, adult dyslexics represent a pool of talent that is possibly being overlooked by employers. Although some expense is involved, employers might consider making some relatively minor changes in their selection procedures to allow professionally diagnosed dyslexics to compete more adequately for a wide variety of jobs requiring written tests. Such minor changes might include:

(a) allowing liberal time limits for power but not speeded tests; (b) providing tests in braille, large-size type and standard-size type; (c) providing auditory testing on cassette tape or by a reader; and (d) replacing some test items, such as letter series and certain figural series items, with other items that measure the same ability.

An excellent source for more information about dyslexia is the Orton Society in Baltimore, Maryland. Its publication, the *Bulletin of the Orton Society*, is a major source of reference to literature on dyslexia, and its *Cumulative Index*, in conjunction with Rawson's (1974) annotated *Bibliography on the Nature, Recognition and Treatment of Language Difficulties*, directs the reader to virtually all materials pertaining to the topic.

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