

CONCEPTUALIZATION AND SYMPTOMATOLOGY OF DYSLEXIA: PROBLEMS AND PROPOSED SOLUTIONS

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Dyslexia could be described as the syndrome that is best exemplified by the unexpected severe reading retardation which is not caused by any known medical, intelligence, psycho-educational or environmental factors. It affects the lives of millions of people world-wide often with devastating psychological, social, and educational consequences. At least 1%-3% of the total population suffers from dyslexia of varying degree of severity; most of those classified as learning disabled, and about 20%-30% of those cases classified as having "general academic retardation" are probably dyslexics. In addition, a similar number of children also suffer from attention / concentration problems with learning disabilities.

A major difference between dyslexia and other kinds of reading retardation is that, unlike dyslexia, other categories of reading retardation can be predicted on the basis of neurological, intelligence, socio-economic, educational, and psychological (motivational, emotional) factors known to adversely affect the reading process. If, for instance, a child has problems in one or more of the above-mentioned areas i.e., comes from low socio-economic background, has severe psychological problems, and has high rate of absenteeism, he is expected to have reading problems. The extent of the reading retardation/backwardness is determined by the severity and number of negative factors that are involved (Downing and Thackray, 1975).

In contrast, there are certain children (dyslexics) who can have all the above factors can be favorable and still have severe reading problems which can not be explained by any of the factors known to cause reading problems (Downing and Thackray, 1975; Dobbins, 1984). The main characteristic of dyslexics is their unexpected reading failure (Rudel, 1980; Symmes and Rapoport, 1972), their bizarre spelling, and sometimes illegible handwriting. It must be emphasized, however, that certain neurophysiological [i.e. abnormal eye movements (Jost, 1988)], behavioral and early developmental signs of the dyslexia syndrome precede the manifestation of the reading problem. These early developmental problems/signs include delayed language development (in about 20% of the cases) and sequential problems (in more than 50% of the children) with, for instance, putting clothes on in the correct order, remembering the order of the days of the week, of the months of the year, etc. (Pavlidis, 1981B).

Dyslexia and other reading disabilities are frequently indistinguishable on the basis of reading and some other educational symptoms (Shapre 198). They have similar psychoeducational profiles.

Eye movements, however, recorded during reading and non-reading tasks clearly differentiate the two groups (Pavlidis, 1981a; 1985b). It is, however, important to differentiate between dyslexia and general reading retardation - backwardness because they have different

causes and prognosis. Whereas other forms of reading retardation can be caused by adverse psycho-environmental factors such as those mentioned above, dyslexia is caused by a brain malfunction.

Environmental factors can NOT cause dyslexia, but they can contribute to its severity or amelioration. As socio-economic, educational, psychological problems, and low intelligence can NOT cause dyslexia, its only plausible remaining cause is a brain malfunction (Critchley, 1981; Geschwind, 1986; Galaburda and Kemper, 1979; Masland, 1981; Pavlidis, 1981b). Indeed, the neurological basis of dyslexia is almost universally accepted (Critchley, 1981; Geschwind, 1986).

Pavlidis (1981b, 1985a) suggested that if the causes of dyslexia are neurological then dyslexia, as is the case with other neurological conditions, should occur in all psychological, socio-economic, and intelligence levels. Additionally, dyslexia should also manifest itself in tasks other than reading. Such tasks should simulate important components of the reading process i.e., sequencing, attention, and oculomotor control, and should be controlled by the same or associated parts of the brain that are controlling the reading process.

SYMPTOMS OF DYSLEXIA

Dyslexia affects primarily males - for every female with dyslexia there are 3-5 males - and tends to run in families, strongly suggesting a genetic component (Labuda and DeFries, 1986; 1989). As outlined in Table 1, dyslexics are plagued by a host of deficiencies in performing various sequential tasks and in their abilities to process various types of information. Most of these symptoms are aggravated by stress. Interestingly, many dyslexics have superior spatial abilities, which is reflected both in their appropriate WISC-R subtest scores and also in their hobbies.

TABLE 1. DYSLEXIA SYNDROME: SYMPTOMS

Dyslexia is a syndrome and its problems go beyond reading & spelling.
Runs in families.
There are 3-5 males to one female.
Unexpected severe reading, spelling and sometimes math problems.
Unexpected significant discrepancy between potential for achievement and actual school achievement.
Inconsistent school performance (e.g., may get A in sciences, and fail in English).
Slow to learn automated-fast sequences, verbal or non-verbal.
Do not read for pleasure.
Frequently have superior spatial abilities.
Frequently visual thinkers.

READING DIFFICULTIES

Painfully SLOW reading.
Monotonous reading tone.
Difficulty in reading handwriting, sometimes even their-own.
Abbreviate words (reading - read).
Substitute words (Physician - Doctor).
Omissions of filler words (a, the).

Grammar errors (I are dyslexic).
Mispronunciation.

SPELLING DIFFICULTIES

Bizarre spelling.
Cramped, illegible handwriting.
Persisting reversals (was - saw) beyond 7-8 years of age.
Inconsistent spelling of the same word, even within the same sentence.
Spelling long words.
Punctuation.
Very SLOW handwriting.

ORAL LANGUAGE PROBLEMS

Delayed spoken language.
Many make similar errors during speech as during reading / writing. About 50% of dyslexics exhibit problems with sequential oral language.

PRIMARY ATTENTIONAL - CONCENTRATION PROBLEMS

Short attention span.
Easily distractible
Hyperactive.
Impulsive

DIRECTIONAL CONFUSION:

Left - Right discrimination.
Following (verbal) directions.

SECONDARY PSYCHO-SOCIAL PROBLEMS

Their psychological problems mainly result from school failure and frustration, and non-supportive attitude at school or home.
Hypersensitive to criticism.
Low self-esteem.
Do not take credit for success.
Low self-confidence.
Give up rather easily.

SHORT-TERM MEMORY / SEQUENCING PROBLEMS:

Remembering directions.
Reciting poems or songs.
Remembering math tables.
Rote memory.

SEQUENCING PROBLEMS

Slower learning of automatic performing various sequential tasks (e.g., putting on clothes, tying shoe laces, etc).
Reverse order of letters of alphabet.
Reverse order of days of week or months of year.
Reverse order of letters within syllables (on - no).
Reverse order of syllables within words (was - saw)
Reverse order of words within a sentences (syntax).
Especially severe problems in remembering the reverse sequence of the above mentioned tasks.
Disorganized.

TIMING / COORDINATION PROBLEMS

In coordinated / timed actions (e.g., ball games).
Keeping a rhythm (dancing, marching, singing).

EYE MOVEMENT PROBLEMS

Erratic, highly variable eye movement patterns and characteristics are exhibited by dyslexics during reading and non-reading sequential tasks that simulate the non-verbal aspects of reading.

Their inconsistent eye movements do NOT reflect a visual or an eye muscle problem, but a brain malfunction.

Dyslexics can exhibit a few or most of the above symptoms in varying degrees of severity. It should be emphasized that a child can have one or more of the symptoms of Table 1 and still not be a dyslexic. Diagnosis is cumulative and comprehensive; the more symptoms the child exhibits, the greater the likelihood that he/she is dyslexic. Someone who has all the symptoms, especially the severe reading problems, is likely to be a dyslexic. Also, among diagnosed dyslexics, the more symptoms are present, and the worse they are, the more severe the dyslexia is likely to be.

Dyslexia is a syndrome and as such it expresses itself in a number of different ways (Rourke, 1989). Most dyslexics are likely to belong to one or more of the many subgroups, i.e., those who have problems primarily with the 1) visual modality, 2) auditory information, 3) visual and auditory (mixed), 4) with attentional - concentration, or 5) with sequential processing. It is important to correctly diagnose the subgroup to which the person belongs because the method of treatment way vary for each subgroup.

DEMOGRAPHIC RESULTS

The following demographic characteristics are derived from questionnaires filled out by parents of dyslexics and normal readers who passed all the inclusion criteria for each category (Pavlidis, 1989a) and participated in our major study across the USA.

When Was Dyslexia Detected The average age that dyslexia was detected was 7 years 4 months with standard deviations at 3 years and 4 months. It is even more interesting that a crucial period of seventeen months lapsed between the time the diagnosis was made and before something was done about dyslexia. It meant that on average the child was 8 years and 9 months old before any action was taken to seek help for the child.

The fact that our subjects were students of boarding schools for dyslexics meant that they came from a self selected group of families who were aware of the problem of dyslexia which was running in many of the families and, hence, they were looking for the possible existence of the condition in their own children. It is, therefore, reasonable to assume that for the average family the detection, if it ever takes place, will occur at a much older age. The later the detection the lesser the chances for amelioration of the condition.

Reading - Spelling and Math Scores The worst performance for the dyslexics was in spelling. Fifty-one out of eighty-seven children were tested for spelling. They scored at the lowest 10.3% of the population, with a standard deviation of 14.54%. Their scores ranged widely from 1% to 82%. Seventeen dyslexics out of 87 were tested for math. The average score placed them at the worst 21.88% with a standard deviation of 20.89%. Their performance ranged widely from the worse 2% level to 88%. The above spelling and math scores

indicate that some dyslexics had severe problems while a small number of them did better than average. Overall the dyslexic's worst performance was in spelling, followed by reading and then by math.

Special Academic Help - Homework Dyslexics worked hard, spending an average of 6.4 hours on homework compared to 4.4 hours for the normal readers. Some dyslexics spent an average of 18 months in special schools, 15 months in special classes, 16 months in resource rooms, and 11 months in home tutoring; yet, their performance in reading, spelling, and math was extremely poor. Their poor performance was displayed despite higher than average I.Q. scores. Dyslexics seem to spend a lot of time watching TV (8 hours per week) as opposed to only 0.3 hours for the normal readers. Of course, watching TV does not require reading. Another beloved hobby for dyslexics is building and construction where they spent an average of 2.5 hours per week in contrast to only 0.1 hour for the normal readers. This visuo-spatial preference for the dyslexics is congruent with their high scores in all visuo-spatial- construction subtests in their IQ scores. Both dyslexics and normal readers had a good attendance record as they had an average of about three days of absenteeism per year.

Adoption It was surprising to find that four times as many dyslexics (8%) were adopted as normal readers although they both came from similarly advantaged socio-economic backgrounds mainly from professional, educated "parents." Similar findings were recently found by Dr. L. Silver (personal communication, 1987). The higher than expected adoption rate for dyslexics may be due to the fact that usually the children who are put up for adoption are the outcome of teenage mothers and high risk groups who do not take good care of themselves during pregnancy (i.e., drinking, smoking, etc.). However, other as yet unknown factors may also be at work.

Hearing Problems Hearing problems in younger ages were more than twice as frequent in dyslexics (10.5%) than in the matched normal controls (4.1%).

Laterality No major differences in laterality were found between the two groups either for hand, foot, or ear preference. If there was a small bias towards left preference, it was for the normal readers. The right handers were about 79%, the left handers about 15% and the remaining were bilateral in both groups. There were also no stutterers in our groups.

Language Problems Less than about 20% of the dyslexics had mild problems understanding or speaking the language. Normal readers had no problems.

Health About 18.6% of dyslexics had frequent headaches, 23.5% had earaches, 15.1% asthma, 10.5% abdominal pain; almost 30% of them had allergies and were on medication sometime in their life, while about 40% of them were on Ritalin at some time for hyperactivity-attentional problems.

Psychological Problems Eleven times as many dyslexics developed emotional problems after starting school (44%) as normal readers (4%). The emotional problems of dyslexics were triggered or enhanced by the frustration that resulted from the continuous school failure.

Personality Characteristics The dyslexic is a more sociable,

more outgoing, more aggressive, more temperamental, more impulsive, more inattentive, more distractible, more energetic, and more hyperactive than the normal reader. In contrast, the normal reader is more relaxed, more optimistic, more self-confident, more cooperative, and more persistent than the dyslexic child. These differences may be secondary to the continuous school failure and frustration the dyslexics experience and/or may reflect a certain amount of predisposition for these traits.

Food Cravings About three times as many dyslexics exhibit food cravings for certain foods such as chocolate, milk, soft drinks, candy, and cookies/bread than normal readers do.

School Changes School problems forced a school change in 64% and behavioral problems in 15% of the cases for dyslexics (0% for normals). When school changes were forced on normal readers in 55% of these cases the reason was a family move to another location.

Sequential-Order Problems The most striking difference between the two groups was found in tasks that require putting items in order. In sharp contrast to dyslexics, normal readers had almost no problems in any of the sequential tasks. Dyslexics reportedly, even after the age of 7-8 years, mixed the order of the days of the week (47%), months of the year (57%), words in a sentence (44%), letters in words (69%) and math tables (45%). More than half of our dyslexics exhibited one or more of these sequential problems.

Short Term Memory Problems or Rote Memory Difficulties Severe problems were also reported for dyslexics in tasks involving rote or short term memory for not logically related/inferred items. For instance, 51% had problems in following verbal directions, 31% in remembering the words of songs, 41% in remembering phone numbers.

Timing Problems Problems were also reported in keeping a rhythm (24%), skipping a rope (21%), singing (24%), and dancing (19%). Apart from the timing skill, these tasks also require the employment of some ability to remember certain order, i.e., the order of steps in dancing.

DYSLEXIA: SOURCES OF ITS MISUNDERSTANDING

Dyslexia is one of the less understood syndromes in the fields of neurology, psychiatry, psychology, ophthalmology, optometry, and education. The misunderstandings arise from the incomplete definition of the syndrome of dyslexia, from the contradictory data and theories that surround its etiology, and from the lack of accurate and unequivocal methods of diagnosis. Lack of knowledge as to the exact causes of dyslexia has forced the adoption of definitions based on exclusionary criteria. But such diagnosis creates serious problems for researchers, clinicians, and patients because dyslexia cannot be diagnosed until after the child has been failing in school at least for a year and a half. By that time, constant failure may have produced aversion for school, undermined self-esteem, self-confidence, and created psychological problems, while the brain has become less "flexible." Thus, treatment becomes less effective than if an earlier diagnosis was made ().

Another major factor contributing to the misunderstandings of dyslexia stems from the fact that in most dyslexia studies the

selection criteria of the populations used were not comprehensive enough to produce a relatively uniform population i.e., their possible causes, the kind, the degree and the severity of the reading problems were highly variable. In addition, dyslexia can occur with or without attentional or hyperactivity problems of varying degrees but this factor has been taken into account only in a handful of papers.

It is important when a diagnosis of dyslexia is made to mention the absence or presence and the degree of the attentional problem.

And finally, because adverse psycho-environmental factors can cause reading problems, dyslexia cannot be unequivocally diagnosed by exclusionary criteria in children who are:

- (a) psychologically maladjusted prior to beginning schooling;
- (b) from a disadvantaged socio-economic background;
- (c) educationally deprived; or
- (d) of low intelligence.

Control Groups:

The importance of employing the appropriate controls is frequently overlooked. And yet, the ability to receive the valid answer to a question is frequently determined by the choice of the appropriate control group. Regardless how well designed a study is, it will probably fail to provide the desired answers if inappropriate controls are chosen. We briefly review below the various types of controls that have been employed for the study of LD/ dyslexia.

Age matched: It is customary to compare dyslexics with normal readers matched on I.Q., socio-economic background, and chronological age. Such a comparison provides the degree of deviation of the dyslexics performance from the norm, and establishes that the two groups are different from each other in the task under study. I does not, however, usually tells us much about the sources of these differences.

Dyslexic's reading age matches control's chronological age: This control group is infrequently used. This matching answers the maturational lag hypothesis [which assumes that dyslexics' lower performance is due to a developmental lag, and that someday in the future that performance will accelerate and will catch up with that of the normal controls]. If, however, the dyslexics show significantly worse performance than the younger controls the maturational lag hypothesis is rejected. In fact this has been the outcome of most studies of dyslexia (Bradley and Bryan, ; Pavlidis, 1981b). Even this matching fails to answer the question whether dyslexia is a condition distinct from other types of non-dyslexic reading retardation as it does not tell us how much of the dyslexics' inferior performance is the consequence of their reading problems.

Chronological and reading age matching of dyslexic and non-dyslexic retarded readers: This design overcomes the limitations of the previous two matching methods. It neutralizes the possible negative effects that could stem from bad reading habits, and reading retardation per se. It can provide the vital information needed to discover the potential causal differences between dyslexia and other types of non-dyslexic reading retardation. As a matter of fact this design is the most appropriate to prove or disprove the existence of dyslexia as an entity distinct from other forms of reading retardation. Almost no symptom or condition can be exclusively

attributed to dyslexia unless it is first proven that does not also characterize the non-dyslexic equally retarded reader.

This design was first employed by the author (Pavlidis, 1981b; 1985b). It is the most time consuming, laborious and sophisticated matching method. Its results are much more sensitive to the precision of the subject selection criteria used than in any other matching procedure. If these are not comprehensive and precise enough the results of such a comparison will be rendered even more meaningless than of studies with different controls. The precise and appropriate diagnostic criteria are of vital importance because the dyslexics and the controls are seemingly the same population as they have the same age and the same level of reading difficulties. Their psycho-educational profile is also similar (Sharpe,).

In addition, due to the shortcomings of the currently used exclusionary diagnostic criteria (for instance, dyslexics cannot come from low socio-economic background, have high degree of absenteeism, etc.) a number of children classified as non-dyslexic retarded readers because they come from adverse socio-cultural background or they have primary psychological problems or lower I.Q. is possible to also be undiagnosed dyslexics. The unwittingly inclusion of an undetermined number of dyslexics in the control group will make it so much harder to obtain significant differences between the two groups. But when such differences are found they are likely to be stronger than they look. The thorough, and comprehensive quantitative subject selection criteria used in our studies were instrumental in bringing out the existing significant differences between the two groups to come out (Pavlidis, 1981b; 1985b).

Even if all the known factors known to influence the reading process were taken into account in the selection criteria for dyslexia, the use of qualitative criteria could still lead to the selection of very different populations. It is not enough just to choose the correct control group, but to also carefully match the groups on the basis of comprehensive, quantifiable criteria. The stricter the criteria the more the subjects needed to be screened to obtain an appropriate sample. Unfortunately, the extra expense and time needed become prohibiting for most researchers. It is, however, necessary to adopt strict criteria for research to overcome the confusion which results from the compromised subject selection criteria.

Most subject selection criteria aim at satisfying certain minimums but this can lead to the selection of differing populations. Take for instance the criterion for minimum reading retardation of 2 years. A child with 2 years and another child with 6 years reading retardation will pass the minimum criterion although the second child is 450% more retarded in reading than the first. So, the same criteria can lead to the selection of dissimilar populations and consequently to different results. This problem can be significantly reduced by establishing not only a minimum but also a maximum criterion differing from the minimum only by a reasonable amount i.e. by 1-2 SD.

THE NEED FOR POSITIVE DEFINITION: It is thus desirable to develop an objective diagnostic method and a definition that would identify dyslexics on the basis of positive behavioral, psychological, and / or neurophysiological criteria such as abnormal or erratic eye

movements (Pavlidis, 1985a), brain mapping or evoked potentials (Conners, this volume).

A major advantage of a positive definition of dyslexia is that it would make possible an unequivocal diagnosis even in children from disadvantaged socio-cultural and educational backgrounds, as well as in children who are psychologically disturbed or of low intelligence, irrespective of race.

Unfortunately, our current knowledge does not lend itself to a positive definition of dyslexia. It is, therefore, imperative to utilize comprehensive exclusionary diagnostic criteria when studying dyslexia. In this way, all factors known to negatively influence the reading process can be taken into account (Downing and Thackray, 1975; Dobbins, 1984). Each of these factors has to be precisely defined and quantified in order to differentiate dyslexics from other retarded readers in a way that is replicable and meaningful (Pavlidis, 1981b; 1985b). These general principles of subject selection have not usually been observed in many studies of dyslexia either for the selection of dyslexics or for the matched normal controls.

The importance of establishing and using comprehensive quantifiable research diagnostic criteria for dyslexia can not be stressed enough (Pavlidis, 1983; 1989). Only the establishment and use of such criteria will provide the knowledge needed to determine WHO and WHAT we study. Uniform quantifiable research criteria will allow the comparison of similar subjects which, in turn, will lead to a better understanding of the causes of the various kinds of reading disabilities and will render the comparisons of results of various studies meaningful.

RESEARCH DIAGNOSTIC CRITERIA

The above mentioned points about subject selection criteria were taken into account in the design of our studies. The enormous variability that exists in the diagnostic criteria for dyslexics is reflected in the fact that only a small percentage of the children that were diagnosed by different sources including school diagnosis as learning disabled also passed our research diagnostic criteria for dyslexia given below. Research criteria are usually stricter and more quantifiable than clinical criteria.

The main aim of our criteria was to exclude any environmental and psychological factors that could be considered as a primary cause of the reading problem. The demographic information about family, developmental, medical, educational, and personal history was obtained through questionnaires filled out by parents and supplemented from interviews with the children just before testing them. In very few cases additional information was obtained through a telephone interview with the dyslexic's parents. Most of this information was used to check whether or not the child fulfilled our inclusion criteria, which are described below.

INCLUSION CRITERIA FOR DYSLEXICS

Dyslexics had to fulfill all the following criteria to be included in our studies:

1. Normal Intelligence: Full-Scale, Performance or Verbal IQ

equal or greater than normal range (minimum 1 SD below mean, plus 2 SE; i.e. WISC-R 92 verbal or 94 performance); and neither score less than 85.

2. Reading retardation relative to CA: At least 2 years retarded if > 10 years old or 1 1/2 years retarded if <10 years old. Reading scores derived from the average score from the Woodcock Reading Mastery Tests of word identification (Woodcock, 1973).

3. Normal or corrected vision (greater than 20/40). Excluded are: amblyopia, nystagmus, or oculomotor disturbance caused by known neurological disease.

4. Normal or corrected Hearing: able to detect pure tones less than or equal to 15 db for frequencies 500-4000 Hz.

5. English is the language spoken at home [which will vary from country to country].

6. Average or above-average socio-economic background, defined as at least one of the following: (a) One or both parents/guardians have finished at least 1 year of college; (b) Minimum income at or above-average for the state of residence; (c) One or both parents/guardians hold a professional occupation.

7. Not on any psychoactive medication or within its washout period.

8. Adequate educational opportunity defined as: (a) No more than two school changes during the first three years of school and/or not more than one change within a 12-month period (excluding normal transfer from nursery to primary to secondary school). (b) Absent not more than 10% of the school days during any of the first three years of schooling.

9. No overt physical handicaps that could account for reading problems (e.g., brain injury, malformation, tumor, seizures)

10. No overt emotional problems defined as: (a) referral for psychological problems prior to beginning reading.

Important point: Dyslexics must be tested for attentional deficit hyperactivity deficit (ADHD). Their data can then be analysed separately, without and with the inclusion of ADHD children in the dyslexic group.

INCLUSION CRITERIA FOR RETARDED READERS

Retarded readers and dyslexics must be of the same chronological and reading age. They mainly differed in their psycho-socio-economic background. They should be drawn from socially disadvantaged and/or educationally indifferent homes. The reading retardation of every single case could be accounted for by one or more of the factors listed below.

However, the possibility cannot be ruled out that some of the retarded readers of this or any other study could be dyslexics as well.

If this is the case then the chances to find significant differences between dyslexics and retarded readers would be reduced. The criteria for the selection of the retarded readers must be the following:

1. At least 1.5 years retarded in reading if below 10 years and at least 2 years retarded in reading if equal or above 10 years (with reading retardation assessed relative to chronological age).

2. Normal vision (people with nystagmus must be excluded).

3. Normal hearing.

4. They did not have any overt physical handicaps that could account for their reading problems such as brain injury and/or

tumor.

5. Their reading retardation was attributable to adverse environmental factors such as disadvantaged socio-economic background and/or lack of educational opportunities and/or emotional problems. (Table 2).

INSERT TABLE 2 HERE

So criteria 1,2, and 3 must be identical for retarded readers and dyslexics. Only the possible causes (psycho-socio-environmental) of the reading problems of the two groups must be different.

INCLUSION CRITERIA FOR NORMAL READERS

The normal readers met the same criteria as the dyslexics with the exception of the criterion (# 2) concerned with reading level. That is, where dyslexics are required to be at least two years behind in reading, normals are required to be reading at grade level or above. They were also free of any attentional-concentration, and impulsivity problems. In employing the same selection criteria for dyslexics and normals, subjects were essentially matched for age, SES, sex, and IQ.

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