DOCUMENT RESUME

ED 111 133 | EC 073 466

AUTHOR	Bannatyne, Alexander
TITLE	The Spatially Competent Child with Learning Disabilities (SCLD): The Evidence from Research.
INSTITUTION	Bannatyne Children's Learning Center, Miami, Fla.
PUB DATE	[75]
NOTE	47p.
EDRS PRICE	MF-$0.76 HC-$1.95 Plus Postage
DESCRIPTORS	*Auditory Perception; *Etiology; Exceptional Child Research; Genetics; Hyperactivity; Incidence; *Learning Disabilities; Maturation; Memory; Perceptually Handicapped; Research Reviews (Publications); *Space Orientation; *Theories

ABSTRACT

Research is reviewed in support of the author's hypothesis that the majority (60 to 80 percent) of learning disabled children are not brain damaged but have above average spatial ability and major deficits in auditory-vocal memory processing which are genetic in nature. Research is reported to support other aspects of his hypothesis such as the lack of visual problems in the spatially competent learning disabled (SCLD) group, the frequent occurrence of a general maturational lag in SCLD males, and the common presence of hyperactivity is also due to an inherited maturational lag. Research is reviewed in the areas of birth order, sex of siblings, neurological impairment, pregnancy and perinatal factors, hyperactivity and brain damage, the nature of hyperactivity, the management of hyperactivity, the inheritance of specific abilities and disabilities, specific abilities underlying reading and other language processes, the good spatial ability but poor auditory-vocal memory skills in SCLD children, the incidence of SCLD children, and the effectiveness of remediation programs. (DB)

THE SPATIALLY COMPETENT CHILD WITH LEARNING DISABILITIES (SCLD): THE EVIDENCE FROM RESEARCH

by Alexander Bannatyne, Ph.D.

Director, Bannatyne Children's Learning Center

6950 N.Kendall Dr., Miami, Florida, 33156

At the ACLD 1966 Convention in Tulsa (Bannatyne, 1966b) I outlined a classification of the characteristics of intelligent learning disability children which I had formulated in the early sixties from both clinical practice, teaching and research findings. My formulation of the nature of learning disabilities (excluding the mentally retarded) included:

1. Spatial competency with poor auditory vocal memory functioning, genetic in origin (SCLD).
2. Minimal neurological dysfunctions (MND).
3. Communicative disorders resulting from inadequate language training in childhood.
4. The socially disadvantaged.

This paper will focus only on the first two groupings of learning disability characteristics. My grouping of Minimal Neurological Dysfunctions at that time included visual, auditory, motor-kinethetic, integrational and conceptualizing deficits, and of course mixtures of these disorders. These were discussed in considerable detail in a later book (Bannatyne, 1971). The term Minimal Neurological Dysfunction was reserved for those children whose characteristics and etiology were strongly indicative of specific or diffuse malfunctioning or impairment of the brain.

The characteristics of the Spatially Competent Learning Disabled child (SCLD) were also outlined (Bannatyne, 1966b) and later described in detail (Bannatyne, 1971). Note that at that time I called this group "genetic dyslexics." The following list is a summary of the characteristics of the SCLD child that I wrote almost a decade ago.

Major Characteristics of the SCLD Child (not all need be present).

1. Often poor auditory discrimination of VOWELS.
2. Inadequate phoneme-grapheme sequencing memory (for matching).
3. Poor sound blending and/or auditory closure on experience.
4. Mildly deficient speech development and feedback which may persist.
5. Maturational lag in most language functions.
6. Reasonably efficient visuo-spatial ability.
7. Unlateralized gaze (when reading).
8. Mirror imaging and writing of letters (hemispheric in origin).
9. Directional configuration inconstancy also causing mirror imaging of letters.
10. Difficulty in associating verbal labels to directional concepts but no visuo-spatial disorientation of any kind.
11. Residual spelling disability.
12. Poor self concept.

IS THIS CLASSIFICATION OF THE CHARACTERISTICS OF S.C.L.D. CHILDREN JUSTIFIED BY THE RESEARCH EVIDENCE?

As I will show in this paper the research evidence supporting my SCLD classification of characteristics is extensive. As I have frequently said in the past and present, SCLD children form the lower end of a normal population continuum in terms of auditory-vocal language functioning. Furthermore my early statements that the SCLD group probably make up the majority of the learning disability population as a whole has been clearly supported by the research evidence. There is even more research support for the statement that SCLD characteristics are mostly inherited.

ONE MORE CHARACTERISTIC - - HYPERACTIVITY - - NEEDS TO BE ADDED TO THE SCLD LIST

In my earlier classifications and descriptions of SCLD characteristics I did not sufficiently stress the influence of the generalized maturational lag on motor functioning because my main concern was to empahsize visuo-spatial competence and auditory-vocal deficits as causes of reading underachievement. However I did say, "It is as if the usual normal maturational lag in males both biophysical and neurological (but not MND) is exaggerated in genetic dyslexic boys. This would account for slight physical clumsiness in these boys in some cases." In the light of subsequent research I would now update this statement by saying: "The exaggerated normal maturational lag in SCLD children is frequently associated with both hyperactivity and a developmental lag in motor functioning (both genetic in origin) which may result in clumsiness and in attentional problems in some specific learning situations."

THE SCOPE OF THE RESEARCH PAPERS REFFERRED TO BELOW

In order to be as complete and as "fair" as possible I perused every research paper I could find in the more popular,available journals. A few were not relevant, but there has been no attempt to screen the research papers for those which would support my classification of L.D. characteristics. By and large I have included almost every research paper I found with one particular type of exception, namely, those global reviews of indadequate researches (which were based on poor research designs) into the effectiveness of certain types of training or procedures.

SPATIAL ABILITY - - A DEFINITION

Spatial ability is defined here as the intellectual cognitive ability to manipulate objects and their relationships, concretely or abstractly, in one, two, three or even more dimensions of space. Many spatial problem solving tasks are non-sequential; for example, in solving a block design problem, it matters little which blocks are used first. My Spatial Ability Category on the WISC is comprised of the combined scaled scores of the Picture Completion, Block Design and Object Assembly subtests (Bannatyne 1966b, 1971, Rugel 1974a).

BASIC CONFUSIONS OVER FOUR TYPES OF SCIENTIFIC CAUSALITY

Although I have previously delineated (Bannatyne, 1971) the four basic types of causality (from Aristotle) it is in the interests of scientific logicality to reiterate them briefly here.

1. Original (or efficient) causes refer to the original causal agent. Eg., genes, rubella, accidents.
2. Material causes refer to the physical material. Eg., brain lesions, biochemical activity, slow-maturing nerve fibers.
3. Program (or formal) causes refer to the plan, programs, pattern or systems. Eg., developmental pattern, computer programs, maturational lag.
4. Final causes refer to the final goal, objective, reason for being, purpose, adaptive need. Eg., the final cause of a meal is the eating of it; one final cause of college courswork is obtaining a degree; a final cause of learning disabilities is grade level achievement expectations.

Any total event, situation, circumstance, etc., can only be described fully in terms of all four types of causes, not just one. But in the literature of learning different authors will often utilize only one cause and that is usually the one closest to his own profession and outlook or viewpoint. Thus one person will speak of birth injuries (original causes), another of biochemical factors (material causes), another of maturational lag (program cause) and still another of self-concept goals (a final cause), without each one realizing their four types of causality are all quite compatible but of different types. Furthermore no one explanatory cause offered in isolation is complete - - in fact it is three causes incomplete.

What then has research to say about the various causes of learning disabilities?

BIRTH ORDER, THE SEX OF SIBLINGS AND LEARNING DISABILITIES

Vockell and Bennett (1972) as a result of a thorough investigation concluded that their results provided no support for the hypothesis that birth order or sex of siblings are related to the incidence of learning disabilities. They also suggest that the contradictory results found in Greer and Whitley (1971) are the result of changes in the birth rate (Hare and Price, 1969) or other artifacts of the analysis (Rees and Palmer, 1970).

SPATIALLY COMPETENT L. D. CHILDREN ARE NOT BRAIN DAMAGED

The objective of this paper is to produce a large amount of research evidence (to add to that already published in Bannatyne, 1971) in strong support of the following statements.

1. The majority (60% to 80%) of L. D. children are not brain damaged in any meaningful usage of that term.
2. The majority (60% to 80%) of L. D. children have above average Spatial Ability on the WISC and equivalent tests.
3. These Spatially Competent L. D. children have no visual problems as a group. (In some rare cases visual problems may occur.)
4. These SCLD children almost always have (as their major "syndrome") deficits of auditory-vocal memory processing - - usually more than one.
5. The auditory-vocal memory processing deficits (in various language functions) are genetic in nature, tending to run in families.
6. They are most likely the result of a maturational lag found mostly in males.
7. Hyperactivity when found in SCLD children is most likely due to a genetically inherited maturational lag in motor functioning, plus the effect of an inherited normal personality trait of "vigorousness" and "outgoing sociability."

In considering the evidence for the above seven statements I will begin with research into brain damage and perinatial (pregnancy and birth) factors.

NEUROLOGICAL IMPAIRMENT, PREGNANCY AND PERINATAL FACTORS,

HYPERACTIVITY AND THE BRAIN DAMAGE HYPOTHESIS.

Hoffman (1971) investigated early indications of learning problems and developed her Learning Problem Indication Index (LPII) for that purpose. The LPII checklist listed many pregnancy, birth and developmental abnormalities. Hoffman totalled them for a sample of children whom she had grouped in terms of "passing" or "failing" academically. From Hoffman's tables I calculated that approximately 87% of the failing children had none or only one perinatal abnormality. (Note that the late Herbert Birch, a neurological specialist in L.D. children, considered one "sign" or "abnormality" insufficient as a perinatal factor - - see later below). In terms of developmental "abnormalities" (maturational lags or "unusual" development) only 12% of the failing students had no developmental characteristic, some 28% had one, 27% had two, 23% had three and 10% had four or more. In other words approximately 88% of failing (L.D.) children had some developmental (maturational) characteristics. Within this 88% some 70% had a speech delay or speech "abnormality," some 50% had creeping problems and 33% were ambidextrous. Three years later Hoffman's L.P.I.I. was used to assess 432 L.D. children at an appraisal center by Wilborn and Smith (1974). Unfortunately original causes (in this case perinatal factors) and program causes (in this instance developmental or maturational factors) are mixed together so one cannot give all the figures for the two categories separately. While 25% of the appraisal center children were involved in a difficult delivery, 24% had a speech problem. 19% had a pregnancy disorder while only 9.4% of the children had a creeping problem. Note the difference between Hoffman's creeping problem figure (50%),and the one in this study (9.4%). On Birch's criteria on of allowing zero or one abnormality as "normal," 56% of the appraisal center children were to use my own term "clear" of perinatal or developmental disabilities. Please note that these are my own interpretations of Hoffman's and of Wilborn and Smith's data because these authors did not use Birch's criterion.

In the next research the children were only referred into the hospital school sample after examination by a <u>neurologist</u> who found them to be "brain-damaged." In this study, carried out by Bortner, Hertzig and Herbert Birch (1972), 14% of the experimental group had zero or one sign of CNS dysfunction, who on Birch's criterion are not regarded as MND children. Remember this is a neurologist-selected MND group, but even so 14% are "clear" of MND signs. Moreover these 14% had high performance/low verbal scores on the WISC and (quote), "there was a relative inadequacy in the verbal spheres. They therefore constitute a distinct subgroup of children designated [I would suggest incorrectly] as brain-damaged and as such warrant more detailed study, particularly in relation to the organization of language functions and symbolization."

The study just mentioned pinpoints the importance of examining the source and nature of the sample involved in L.D. studies. Obviously, samples of children referred to hospital units by neurologists as "brain damaged" are going to contain a much higher percentage of M.N.D. cases than samples drawn from regular school districts on the sole basis of academic failure. This is why the Hoffman and the Wilborn and Smith samples contain a much higher percentage of children with zero or one perinatal and/or developmental factor. It is important, as we continue to explore the nature of learning disabilities in this paper, to remember the 14% of "clear" children in the Bortner, Hertzig and Birch sample who had high Performance/low Verbal scores on the WISC, because I am suggesting that in the light of this paper they are SCLD children with good spatial ability and low auditory memory skills.

Black (1973) in a paper on neurological dysfunction and reading disorders compared 25 L.D. children, who had <u>definite MND indices</u>, with a control group. Surprisingly there were no differences on the WISC scales, or the Wide Range Achievement Test; only on the Frostig test was there a significant difference between the groups. The author concluded that the MND children were <u>inferior</u> in "visual perception." On the basis of EEG and a neurological examination the experimental group was divided into nine left-sided impairment cases and seven "bilateral or difussed" impairment cases. All the tests significantly discriminated these two tiny groups. Subjects with "bilateral or diffuse impairment" did better on the WISC Performance and Full Scales and on the Frostig perceptual quotient. This means that the "bilateral or diffuse" group were visuo-spatially competent and again these particular children look suspiciously like our spatially competent poor auditory memory skills (SCLD) group.

Incidently, subjects with "right-sided impairment" performed better on the Verbal Scale of the WISC, yet again confirming specific hemispheric functions.

<u>Conclusions about "Neurologically Impaired" LD children on the basis of research findings.</u>

It would seem there is always a discernable subgroup who are not "neurologically impaired" even in <u>selected MND samples</u> of children; at the least we can say there are two clearcut clusters of children within each sample.
Perinatal factors (more than one) are not present in a sizeable proportion of each of the samples for which they were recorded.

<u>Speech development</u> and possibly <u>motor development</u> may be key developmental indicators of learning disabilities in childhood.

The subgroup who are NOT-MND usually display considerable spatial ability from right hemisphere activity and seem to have poor left hemisphere "verbal skills."

There is no doubt that within each of the experimental samples there is a group with definite symptoms of neurological impairment. It would appear that in the regular school samples this MND group is in a minority while in the neurologist-selected samples it is in a majority.

These two clusters correspond to my own 1966 grouping of LD children's characteristics.

THE NATURE OF HYPERACTIVITY IN LEARNING DISABILITY CHILDREN

In the minds of most professionals in the field hyperactivity is almost always associated with definite neurological dysfunction in LD children, but what are the research findings to date? Research results indicate that hyperactivity is NOT usually a neurological impairment symptom with an etiology of complex pregnancy or perinatal trauma. Rather, the research evidence indicates that hyperactivity is, in the main, inherited.

Rugel and Gregory (1975) in a research into the incidence of family histories of reading disorders and of pregnancy and birth complications in LD children used a combined sample of 152 LD children selected from school systems plus a matched control sample of 35 regular children. A comparision of the experimental and control groups indicated no significant differences in the percentage of subjects with-or-without birth and pregnancy complications. But the two groups did differ in the percentage of subjects with or without a family history of reading disorders. This confirms much previous research (see Bannatyne, 1971) that learning disabilities tend to run in families with the implication that there is a considerable hereditary factor involved. In the research by Rugel and Gregory the learning disabled with a history of pregnancy and birth complications were significantly lower on the WISC Block Design, Picture Completion and Arithmetic subtests, in other words they were poor in spatial ability. However, subjects with a <u>family history</u> were significantly higher on the Block Design subtest (competent spatial ability) and had more problems of <u>hyperactivity</u>.

This last factor would tend to indicate that hyperactivity as a syndrome is a characteristic of children with a family history. This is an extremely important finding for it suggests that <u>hyperactivity is inherited</u> more often than it is the result from neurological dysfunction due to perinatal and pregnancy trauma.

Rugel and Gregory also found that "a positive family history was associated with increased evidence of MBD pathology on a rating scale." Ingram (1960) found a correlation between perinatal trauma and family histories of some learning handicaps. Therefore it would seem (Bannatyne, 1966, 1971) that abnormal genetic factors may also be operating in some (MND?) children, while in SCLD children normal polygenetic factors are operating. Both types of child would exhibit family histories and this would blur the statistics.

In 1971 Barbara Keogh reviewed past research and came up with three, not mutually exclusive, categories to account for the conclusions in the literature she had surveyed.

I. Neurological Impairment. "The evidence does not allow acceptance of this hypotheses as a definite and broadly encompassing explanation for the learning problems of hyperactive children."

II. Interference of Motor Activity. This conclusion suggests that excessive motor activity interferes with the acquisition of information in a learning situation. "Excessive extraneous movements especially of the head and eyes appear associated with learning difficulties."

Para I would ask that if this conclusion is valid (and I believe it is) why then do the hyperactive children in the study by Rugel and Gregory (1975) have higher Block Design scores on the WISC? It would seem that the children in question are controlling their head and eye movements in a spatial task situation, but not in other situations involving the learning of reading, spelling, or perhaps arithmetic. It would appear then that hyperactive children can attend to some tasks (spatial) but not others (verbal coding and decoding). Later I will present more evidence that much hyperactivity is situation-specific in terms of learning tasks.

III. Rapid Decision Making. This conclusion states that hyperactive children make very rapid decisions in task solving situations. I would suggest that this is an avoidance escape from conflict; in other words these children make rapid decisions in order to get the irritating problem (others want them to do) over and done with. Keogh points out that her three categories are not mutually exclusive, a statement with which I wholeheartedly concur.

Anderson, Halcomb, and Doyle (1973) put a sample of LD children and controls through a simple visual vigilance task of reacting to a green and red light which were presented in various combinations and which required a button-pushing answer reaction from the child. Their findings stated that, "The LD children made consistently fewer correct detections and more false alarms than the non-disabled. Not only did the learning disabled have more difficulty attending to the monotonous task, but they responded to extraneous and task-irrelevant stimuli at a higher rate than did the control subjects."

It is one of my own hypotheses (Bannatyne 1966, 1971) that the SCLD child prefers to move his or her eyes at "random" when scanning the environment in three dimensions because this has survival value for spatial people. If this is so then Keogh's conclusion about excessive extraneous head and eye movements dovetails neatly into my "random scanning" hypotheses and in combination the two suggestions would account for the "poor" vigilance in the research by Anderson, Halcomb and Doyle.

Two patterns of hyperactivity were found by Marwit and Stenner (1972) in a research review paper. Pattern One, which they suggested had a biological etiology, they broke down into three causative subgroups, organic brain damage, maturational lag, and constitutional causes. Note that these categories are not mutually exclusive because brain damage is a material cause, maturational lag is a program cause, while "constitutional" factors are an original cause. The hypotheses about hyperactivity for Pattern Two is that it is learned. Here there are two sub-categories, namely a reactive emotional disturbance type of hyperactivity and an anxiety type of hyperactivity which is expressed motoricaly. Of course (although Marwit and Stenner do not say so) Patterns One and Two are not mutually exclusive in that biological traits can, and most frequently do, have a learned overlay.

It is interesting that Marwit and Stenner imply (a) an MND brain impaired group of children and also (b) a constitutional (or inherited) type of hyperactivity. I would agree that both types exist and furthermore, that both can be inherited, the first from abnormal genes and the second from normal genes. Nor do these two patterns rule out a third true pregnancy or birth trauma or disease-originating MND hyperactivity.

Is Hyperactivity Related to Emotional Disturbance?

In the research review mentioned above the 2 Pattern Two subcategories were both linked with emotional disturbance as a primary cause, so it would seem timely to investigate those research projects which have looked into this aspect of hyperactivity.

Bullock and Brown (1972) had 112 teachers complete questionnaires on 1086 disturbed children who were not necessarily learning disabled. The results were factor analyzed and four factors were obtained. The first factor concerned aggressive behaviors. The second was loaded with "withdrawn" characteristics. Factor three was related to anxiety states. But factor four consisted of three characteristics -- irresponsible in class, inattentive in class, and breaks class rules. Although the authors do not say so this last syndrome (factor four) sounds to me very much like our learning disability hyperactive/inattentive group who have a separate "syndrome" from those emotionally disturbed children whose characteristics are clearly delineated by factors one, two and three. If my interpretation of the results of the Bullock and Brown study is tenable, then hyperactivity is separate from emotional disturbance as defined by aggressive behaviors, withdrawn behaviors and anxiety states.

Barr and McDowell (1972) in a comparison of learning disabled and emotionally disturbed children on three deviant classroom behaviors found that the emotionally disturbed group made significantly more negative physical contact than did the learning disabled children. Also the emotionally disturbed group vocalized between children significantly more often than the LD children. However the emotionally disturbed group did not have significantly more out of seat behaviors than the learning disabled. Summarizing we can say the LD group were less physically aggressive, less vocal with peers but had similar motor out of seat behavior.

In a fascinating study Krippner, Silverman and Cavello (1973) compared 47 children for whom drugs had been prescribed for the purpose of controlling their hyperactivity with 27 children who were not hyperactive. Note that the Drug Group were not on drugs at the time of the research testing. Both groups were tested for "brain dysfunction" on the Graham-Kendall Memory For Designs Test and the Kimkof Perceptual Organization Inventory. The Picture Peabody Vocabulary Test, The Torrance Test of Creative Thinking and the Rogers Personal Adjustment Inventory were also given. The Drug and Non Drug groups did not differ significantly on the tests for "brain dysfunction." This means that most hyperactive children are not suffering from minimal neurological dysfunction according to the diagnostic tests used by the authors. A second finding was that a significantly greater proportion of the Drug Group than the Non Drug Group were found to be emotionally maladjusted on the Rogers Test. However in a third finding there was no significant difference between the groups on the non-verbal spatial (figural) creativity test. But there was a significant difference in favor of the Non Drug Group in verbal creativity. On the P.P.V.T. there was no significant difference between the groups. This suggests the hyperactive Drug Group is as spatially competent as the Non-Drug Group but less competent auditorially. If (as the authors found) the majority of the children in both groups are not MND we are again left with a group of spatially competent LD children who are hyperactive but not brain damaged. By exclusion this suggests the possibility of genetic and/or environmental factors being the original cause.

Further Evidence on the Inheritence of Hyperactivity

The first major factor in normal personality to show up at a high level of significance in several twin studies reported by Vandenberg (1969) was the "active, vigorous, impulsive trait." Interestingly the second major trait of personality to be inherited was the degree to which a person expresses his emotions, in an open, healthy manner in interpersonal relations. The terms "active," "vigorous" and "impulsive" are frequently used in the literature on hyperactivity and so is the need in many of these children to make open direct contact with the teacher. Combined with the research evidence that hyperactivity is often inherited (detailed previously above) there would seem to be little doubt that "most" hyperactive children are on the very "active, vigorous, implulsive" end of the normal distribution of this personality trait in the total population. When this personality trait is combined with a learning disability in a, passive, verbal, sedentary, regular classroom atmosphere, these children just do not fit. One answer might be to have much more activity oriented regular classrooms which will also involve the children in many spatial and motor activities within the curriculum and which will allow more open contact between teacher and child. I am not speaking of open classrooms or schools but highly structured, active, problem-solving, discovery types of classroom.

Hyperactivity Tends To Be Situation-Specific

In an extensive review of the literature on attention deficits in children with learning disabilities, Tarver and Hallahan (1974) concluded, "The hyperactivity studies provide strong evidence that hyperactivity is situation-specific. This supports the increasing speculation that hyperactivity is a socially defined phenomenon. On the other hand, organically based deficiencies in the control mechanis ms have not been completed ruled out." I would make two points here. The first is that "organically based" can mean any biological function including inherited ones. Secondly the conclusion of these authors, that hyperactive children's activities are situation specific (their hyperactivity occurs only in some situations and not others) suggests to me that they may be spatially competent L.D. children who become hyperactive when they are required to control their gaze in specific motononous vigilance tasks such as reading, spelling,etc.

Conclusions and Summary about Hyperactive LD Children on the Basis of Research Findings

1. There is considerable evidence that hyperactivity is often an inherited characteristic even though in a smaller proportion of cases it may be caused by some form of neurological impairment which is usually the result of abnormal pregnancy or perinatal factors. Abnormal genetic factors are another possible cause of the MND type of hyperactivity.

2. As well as being mostly inherited, hyperactivity seems to be often associated with average or above average spatial ability.

3. Hyperactivity would seem to be mostly a motor-expressive characteristic of some L.D. children and the attentional deficits involved include out of seat behaviors and head and eye movements.

4. Hyperactive L.D. children find it difficult to concentrate their attention on monotonous tasks involving visual vigilance where the eyes must not roam. This would tend to support my hypotheses put forward a decade ago that spatially competent children prefer to scan the environment in three dimensions and do not like the discipline of concentrating the gaze in one dimension, especially in the process of reading lines of print from left to right. Tasks requiring monotonous eye-controlled vigilance could account for hyperactivity being situation-specific.

5. Hyperactive L.D. children should not be classified as emotionally disturbed because factor analysis studies suggest these two "syndromes" are not related.

Summarizing we can say that hyperactivity is frequently inherited as a motor dyscontrol leading to poor attention skills in spatially competent (SCLD) children and the poor attention/vigil_nce/impulsivity/distractability/etc., is frequently situation-specific in these children. A second group or cluster of L.D. hyperactive children with genuine minimal neurological dysfunction (MND) does exist but it is probably much smaller than the group described above. The third group of emotionally disturbed (ED) aggressive children should not be labeled hyperactive as it leads to a confusion of terminology and "syndromes." Still other emotionally disturbed children may be also hyperactive though not necessarily aggressive.

The Management Of Hyperactive Children

In a study of 10 learning disability children with defective visual processing on tests such as the WISC Block Design, Shields (1973) discovered that, when given EEG's, these children had longer evoked average response latencies which indicate their nervous systems may operate more slowly than those of normal children. This suggests to me a maturational lag factor (perhaps from brain injury or genetic factors) in this group of children with visual deficits. A second finding in this study was that LD children with visual processing deficits have larger average evoked response amplitudes than other children and this indicates (says Shields) that these children must direct above average attention to a task to process the incoming stimuli. These LD children take longer to react and need to concentrate extra attention to the task in hand. The above findings on children who are visually non-competent are not at variance with the previous motor hypotheses.

Nall (1973) had some very limited (though promising) success using biofeedback Alpha Training with hyperactive children. A few specific children made considerable behavioral gains in terms of reduced hyperactivity, increased attention span, sound sleep, etc. Certainly there is a need for more research in this area especially on finely separated sub-groups of L.D. children so that we can identify the characteristics of those who benefit most from biofeedback training techniques.

An informative practical book on the psycho-educational treatment of hyperactive children has been written by Vallett (1974) and teachers should look into it for many useful ideas and techniques.

THE INHERITENCE OF SPECIFIC ABILITIES AND DISABILITIES

As the beginning of this paper I summarized my hypotheses about the inheritence of specific disabilities of an auditory-vocal nature in SCLD children and in my book (Bannatyne, 1971) I put forth clear-cut research evidence to support those hypotheses. Over the last few years there has been considerable amount of research which adds further evidence that those hypotheses are valid.

Matheny and Dolan (1974) carried out a twin study on the genetic influences in reading achievement. They used seventy pairs of same sex twins aged 9 to 12 years. The authors report that, "The results were in close agreement with findings of previous studies and together are indicative of hereditary influences in reading achievement." The authors then go on to say, " From this view the presence of familial reading disorders can be an expression of any number of forms of inheritence, not because of the reading 'trait' is transmitted in any number of ways but because the processes underlying reading.are."

The above study was carried out on regular children, so let us now look at a research involving twins with reading disabilities. Bakwin (1973) found a history of reading disability in 97 of 676 twin children (14.5%). There were more boys than girls but the boy-to-girl ration was the same for both monozygotic and dizygotic twins. The results showed that 84% of the monozygotic pairs were concordant in their reading disability while on 29% of the dizygotic twins had concordance (significant at .001 level). The author states, "... the basis for reading disability from middle income homes ... is principally genetic." He also adds that the weight of the children at birth was not a factor and that the strong gentic influence was the same for both boys and girls even though fewer girls were learning disability cases.

Having previously established the strong likelihood that hyperactivity is largely in spatially competent learning disability children, we now find that reading ability itself (as a manifestation of underlying abilities and traits) is also largely inherited. What then are the details concerning these inherited abilities, traits and characteristics?

It is necessary to go back to the Vandenberg (1969) twin studies again. He found that the abilities underlying most of the Wechsler Subtest Scores were definitely inherited. The sub-tests included Vocabulary, Information, Arithmetic, Block Design, Comprehension, Similiarities, Digit Span, Coding and Picture Arrangement, and of course the Full Score, Verbal Score and Performance Score. Vandenberg in examining the results of four separate research studies on twins found agreement on the inheritence of Word Fluency, Verbal Ability, and Spatial Ability. On the Differential Aptitude Tests (involving two twin studies) he found strong evidence for the inheritence of Verbal Reasoning, Spelling, Sentences and Clerical Speed and Accuracy. If one analyzes the above abilities and aptitudes one can see the importance of auditory-vocal sequencing since it is involved in word fluency, verbal ability, verbal reasoning, spelling, sentences and coding.

With the irrefutable evidence of all the above studies that the abilities and disabilities underlying reading and verbal competence (and also spatial ability) are inherited it is scientifically logical to look now at other research studies that investigate these abilities and disabilities in their own right, and to make the logical sssumption throughout that it is extremely likely they are inherited characteristics. In other words although most of the research studies I will now review do not expressly mention familial or inherited factors it is almost certain that their findirgs concerning the above inherited competencies and disabilities (verbal and spatial) can also be attributed to hereditary factors. One of the best sources of information about disabilities or deficits is to be found in early screening research which is concerned with identfying, at the pre-school level, those children who are likely to have learning disabilities later in their school careers.

SPECIFIC ABILITIES AND DISABILITIES UNDERLYING READING, SPELLING AND LANGUAGE PROCESSES

Motor Factors and Maturational Lag

The Bender Gestalt Visual Motor Test was used by Norfleet (1973) as a group screening instrument for first grade reading potential. She found that the Bender test was quite accurate in the prediction of good, average and poor reading potential. While no doubt, this is accurate information, what skills does the Bender actually assess? The abilities which an author ascribes to a test are not necessarily valid and this is the case with the Bender. Newcomer and Hammill (1973) gave a sample of 90 motor impaired children both the Bender test and a motor-free test of visual perception. The authors found that while the children tended to perform at their chronological age level on the motor-free visual test they did poorly on the Bender, with the conclusion that the Bender test measures a motor handicap not a visual one. Therefore we can say that Norfleet's early screening success using the Bender registered motor maturation deficits, not visual ones. Once again we have that motor factor coming in as a crucial indicator of potential learning disabilities.

Finger Localization, Balance, Unit Design Recognition and Day of Testing

Satz anf Friel (1974), in investigating the predictive antecedents of specific reading disability in a two year follow-up of a longitudnal study, found that the three best tests for predicting reading disability were finger localization, recognition-discrimination of designs, and the day of testing. In one of my own studies (Bannatyne, 1971) I found that balance was significantly correlated with written spelling and I suggest that finger localization, balance and similar measures are manifestations of a maturational state in children. The predictive value of the recognition-discrimination test (a motor--free memory-for-designs test) corroborates my own research findings and those of others that unit design memory (but not visual sequencing design memory) is an important factor in learning to read successfully. After all, one has to be able to see the unit grapheme shapes quickly and accurately if one is going to be able to read competently. The "day of testing" result (Satz and Friel, 1974) should make all research people aware of taking this variable into account in their research designs. Satz and Friel also used the Beery Developmental Test of Visual Motor Integration a design copying test, which, like the Bender, is mostly motor in terms of the modality assessed. The authors conclude that the high risk group reveals almost a 12 month lag between their chronological age and performance age while in the low risk group the two ages exactly matched. Thus we have here some direct research evidence that maturational factors are a major key in specific learning disabilities. Incidentally the theory of maturational lag tested by Satz and Friel was first put forward by Bender, (1951, 1957).

Mirror Imaging and Maturation

In a standardization research on his mirror imaging test Jordan (1973) found that mirror imaging was a significant maturational factor in terms of both the age and the sex of the child. Boys make more errors than girls and younger children make more errors than older children. In passing I should point out that mirror imaging is a normal maturational characteristic which, in most L.D. children, is not indicative of neurological impairment or visual disorders. Children who mirror image letters see the letter-shape very clearly; it is the sound (phoneme) which is associated with a particular mirror-shape such as 'b' or 'd' that they cannot remember (see Bannatyne, 1971). Hence mirror imaging is essentially an auditory-vocal sound-to-symbol memory problem.

Figure-Ground Discrimination and Figural Closure

La Driere and Hall (1973) in their research found that "There is no apparent deficiency in figure-ground perception . . . within the brain-damaged sample tested." The authors also found that, "There is no apparent deficiency in the ability of brain-damaged children to achieve figural closure . . . simple or complex . . . in fact the brain damaged sample produced proportionately more correct responses than did the control group." The authors conclude by saying, "This is a finding that is directly opposed to the usual prediction in the literature which expects overall deficiency in all perceptual functioning in organics. Yet these data were consistent and similar findings are reported by Vegas and Fry . . ." (Many authors use the term "brain damaged" as synonomous with Learning Disability Children and one must not assume that because the term "brain damaged" is used in any research that the children actually do suffer from neurological impairment.) The sample in the LaDriere and Hall study is visual-spatially competent and, in fact, even superior to the control group. Certainly these visual abilities cannot account for the academic failure of the sample. If most learning disability children do not have visual perceptual problems (and even more research will be presented to support this point of view) it would account for failure of programs like the Frostig materials to help most L.D. children learn. (Buckland and Balow, 1973)

But could some visual factors peculiar to reading, but not abnormal, account for poor "vision" in reading while the same children could have good vision elsewhere in everyday life? Such "deficits" would not exclude concomitant auditory-vocal disabilities; nor would they imply anything wrong with the eyes, with vision, or the visual areas of the brain.

Visual Fields and Reading

The role of visual fields in reading and spelling has always fascinated me and I feel it is a much neglected area of research. Elsewhere (Bannatyne, 1966a, 1971) I have suggested that SCLD children may be right-hemisphere (spatial center) dominant in terms of normal brain functioning and that this would be visually represented by a corresponding left visual field dominance which is incompatible with the fact that Western phonetic languages are read mainly in the right visual field. McKeever and Gill (1972) carried out a study investigating visual half-field differences in masking effects for sequential letter stimuli in the right and left handed. They found that the left visual field superiority for left handed subjects was significant on two initial stimulus letter conditions. Left and right handers were thus most clearly differentiated on the initial letter stimulus rather than on the following stimulus letter. While this study did not directly involve learning disability children, we know that left handedness and ambidexterity are related to learning disabilities and now we find that left handed students see initial letters better in their left visual fields than do others. Because (by chance) Western languages are read in the right visual field we have a visual field laterality or dominance "problem", just as I predicted several years ago. (Please note that visual fields dominance has nothing to do with eye/hand crossed dominance, which is a fiction anyway; Bannatyne, 1971). This dominant left visual field "problem" is only the result of a left-to-right reading-scan convention.

Visual Versus Auditory Presentations of Learning Tasks

From a sample of 28 LD children with no motor or other organ handicaps Estes and Huizinga (1974) found that the children learned a greater amount from visually presented line drawings of familiar objects (no reading was involved), than they learned from auditory presentations. Thus, yet again, it is with the auditory aspect of learning that these LD children had most difficulty. However on groups of normal children Otto (1961) and Budoff and Quinlan (1964a, 1964b) found that auditory presentations provided greater learning than did the visual. The composite conclusion from these three studies is that while regular school children can learn quite well in the auditory modality, LD children do not.

Should Visual Training Techniques Be Used With Visuo-Spatially Competent LD Children?

Some authorities suggest learning disability children should be taught only through their (visual) strengths but the research evidence is against this policy. Belmont, Flegeheimer and Birch (1973) compared "perceptual training" and remedial instruction for poor beginning readers who were mostly neurologically impaired. Yet even on this MND sample there were no significant differences between a combined Frostig and Kephart programs, and other miscellaneous methods of teaching reading academically. It should be noted that this academic reading program was not a fully integrated, multi-sensory reading, writing, spelling and language task-analysed program such as the Bannatyne System (1975).

Buckland and Balow (1973) in studying experimentally the effects of visual perceptual training on reading achievement say in their abstract; "This study was designed to determine the effect of visual perceptual training on perceptual, readiness and word recognition skills of low readiness first grade children. The experimental group worked on Frostig worksheets. Under equally close attention of the teacher, control pupils listened to stories through a headset. Gains in perception, readiness, and word recognition outcome variables analyzed for experimental and control groups within 16 classrooms and between 4 pretreatment perceptual levels showed no significant differences in favor of the experimental group."

It is apparent that training visually competent children on visual programs like the Frostig has no advantages over traditional educational methods. One might add at this point that whole-word, sight (visual) methods of teaching reading have failed to remove illiteracy in the U.S. over the last two or three decades. But for the moment let us continue to look at the deficit characteristics of most learning disability children.

Handedness and Hemispheric Lateralization

Orlando (1973) studied 20 left handed and 20 right handed boys and came to the following conclusion. "Thus it can be said with confidence that some degree of bilateral representation of language occurs in both right and left handers although the tendency is far greater in left handers as shown by their greater variability on all measures... The eight year old children in this study who were most strongly left-eared (right hemisphere language dominant) showed the strongest left handed preferences." The author goes on to say that "Preferences are relativly poor indicators of language representation in the brain . . . it is noteworthy that left and right handed boys performed equally well on the motor proficiency and dichotic listening tasks. If brain damage has been an important causative factor in producing left handeness in this group, one would expect lower mean performance levels in left handers." Thus, once again "brain damage" (MND) does not appear to be a contributory cause to handedness or by implication to the hemispheric lateralization of language. Remembering that this group was not a sample of learning disability children and that no measures of academic achievement were used, it does leave open the strong possibility that other hypotheses such as inherited maturational lags may be the cause since "brain damage" is not.

THE RESEARCH EVIDENCE THAT SCLD CHILDREN HAVE GOOD SPATIAL ABILITY, POOR AUDITORY-VOCAL MEMORY SKILLS, AND A MATURATIONAL LAG

Considerable evidence has already been presented in this paper and elsewhere (Bannatyne, 1966b, 1971) that many learning disability children, (a) have competent visuo-spatial functioning, (b) comparatively poor auditory-vocal memory skills which account for their academic failure, (c) that the "program cause" for their learning disabilities is an inherited maturational lag quite normal in nature, which in turn carries with it, (d) lateralization "complications" in hemispheric dominance, visual field dominance and handedness. Let us now look at still more evidence for these hypotheses. I will begin by examining the more "oblique" research studies and then move into the evidence from the more direct "auditory-vocal" research papers.

In a research into imitation and judgements of 120 LD children with language deficits (plus 48 controls) Schwartz and Bryan (1971) found that the LD children did not differ from normal children in terms of imitation behavior or in the formation of attitudes toward a model. The group differences suggested that learning disabilities subjects had greater difficulty on a memory task of recognition of words heard, of actions seen and on a sequential motor game. One implication is that auditory memory and sequential motor memory tasks are problems for LD children with language deficits. A second implication is that the problems LD children have are not the result of environmental imitations or shaped attitudes.

Visual Recall in Poor and Normal Readers

Vellutino, Pruzek, Steger and Meshoulamb (1973) studied immediate visual recall in poor and normal readers as a function of orthographic-linguistic familiarity. Groups of children were shown three, four and five letter Hebrew words and asked to produce them from visual memory. The experimental groups did not know Hebrew. The authors conclusions were that these data provide direct support for the suggestion that poor readers sustain no organic deficiency in visual-spatial processing.

Dykman, Peters and Ackerman (1973) in a study of 31 learning disability "minimal brain damage" children and 32 controls found that . . . "LD cases differ most from controls in conceptual and sequencing abilities." In this study the spatial ability of the "MBD" group was not significantly different from the control group. (As will be shown below the vast majority of WISC studies on learning disability children demonstrate the superiority of these children over the normal in the area of spatial ability.) Another interesting finding of the Dykman et.al. research group was that the incidence of broken homes was no higher in the MBD group than in the control group. The Dykman et.al. research illustrates beautifully the confusion over terms such as "MBD." The authors say, "This sub-group, learning disabled (LD), encompasses children with learning deficits in one or more basic school skills. The classification MBD excludes children with manifest brain damage; it includes LD children who are not hyperactive, as well as those who are hyperactive. In general and in this study, those who are both LD and hyperactive constitute the majority of cases." Throughout their paper the authors use the terms LD and MBD (from Clements, 1966) interchangeably and I find this not only confusing but research-question-begging, especially so when "Minimal Brain Damage" does not include "manifest brain damage."

Like Vellutino et. al., another research investigator Heriot (1973) has studied attention and short term memory as learning requisites. In a study in which he controlled for IQ and used a control group from a non-referred population, Heriot investigated various memory skills with the following results. "Memory and attentional tests best identified underachievers in both study samples. Memory and attentional subtests generally distinguished between underachievers and achievers better than other tests. The auditory/rote memory tests of immediate recall, particularly the digits backward, both identify and discriminate bettter than the other tests including most memory and attention tests. Rather than having perceptual problems the subjects had difficulty with sequential memory." This last phrase should read auditory sequential memory as it is Digit Span to which Heriot is primarily referring. Thus again the LD children tend not to have visual perceptual problems but rather auditory memory problems.

Syntatic Abilities

The syntatic abilities in oral language of 20 normal and 20 "dyslexic" second graders were assessed in a study by Vogel (1974). He concluded that, "The dyslexics were found to be different from the normal children at a high level of significance on seven of the nine measures all favoring the normals. The dyslexic children were significantly deficient in oral syntax." The three measures identified as the best discriminators were the ITPA Grammatic Closure Test, the Berry-Talbott Language Test, and The Test of Recognition Melody Pattern. It would seem reasonable to suggest that there is a considerable amount of auditory-vocal sequencing memory in oral syntax, especially at the word/sentence level. Certainly there are no visual or manual-motor tasks involved in oral (vocal) syntax.

Wigg, Semel and Crouse (1973) in a research into the use of English morphology by high risk and learning disabled children came to the conclusion that high risk and learning disabled children exhibited differential and qualitativly similar delays in the acquisition of morphological rules. The categories used in the morphological test included plurals, progressives, past tenses, third singular, singular possessives, plural possessives, adjectival inflections, compoundings, and derivations. The authors go on to say, "The implications for remediation are in the direction of developing curriculums which stress verbal linguistic skills." They suggest that this should be done at the kindergarten level.

Continuing our investigation into the deficits many learning disability children have with groups of words or morphology we discover that Loe (1973) carried out a neat study into the paired associate performance of learning disabled boys as a function of stimulus modality and elaboration. "Elaboration" means enriching the meaningfulness of the words to be learned by combining them with other words; eg., to help associate 'cat - flower,' we present the elaborated phrase 'the cat on the flower.' One group of 20 LD boys who had higher WISC verbal IQ scores than performance scores were more successful with the elaborated pairs than with non-elaborated ones. However a second group of 20 students with higher WISC performance scores were less successful with the elaborated pairs. The author suggests increased meaningfulness does not help spatial children, but I would suggest that the results stem from a poor auditory word sequencing memory span which is operating in spite of the increased meaningfulness of the elaborated phrases. We can conclude from this study that the spatially competent learning disabled children cannot remember "elaborated" series of words as easily as they can remember non-elaborated paired ones.

Specific Auditory-Vocal Memory Deficits and Related Specific Disabilities

In the section above evidence was presented for deficits in language processing at the sentence level and these included syntax, word morphology and elaborated phrases. Let us now look at research studies into specific auditory-vocal memory deficits and related problems.

Oliphant (1970) in a study of the factors involved in the early identification of specific language gave the Stanford Achievement Test and several other types of screening tests to a population of 132 children. She ran correlations and came up with the following results. "In general the tests which had a strong auditory component were more highly significant than others. " Specifically she found that the tests of echolalia (in which the subject has to mimic long words spoken by the examiner) which is in effect an auditory sequencing memory task, and sound blending were the best identifiers of specific language disability (excluding academically oriented tests such as signing ones name, etc.). Oliphant also found developmental/maturational factors to be significantly correlated with academic failure on several items of the parent questionnaire. The key items were as follows: Was your child slow to talk? Does your child have a speech problem now? Does your child use his left or right hand or does he switch back and forth? Does your child like to be read to - - or do other things? Does your child have trouble following directions? Note that four of the five questions involve the use of words in language (auditory-vocal) and the other one involves ambidexterity.

Golden (1967) and Steiner (1969) in two separate but parallel studies relating auditory and visual functions to reading achievement obtained the following results. The high reading achievers did not score significantly higher than the under achievers on the ITPA subtests of Visual Sequential Memory or Visual Closure. However the low achievers in reading were found to be primarily lacking in auditory functions as measured on the ITPA.

In a research I carried out with Wichiarajote (see Bannatyne, 1971) we also found that the ITPA (Revised) test of Visual Sequencing Memory was uncorrelated with a test of written spelling. Thus, it would seem from two separate researchs one into reading and the other into written spelling that Visual Sequencing Memory is an irrelevant skill. Therefore, even if our Spatially Competent Learning Disability children are visuo-spatially superior, this superiority will be of no use to them in reading and written spelling because visual sequencing memory is of no consequence. The unimportance of visual sequencing memory to reading and written spelling will also explain why "Whole Word Methods" and "Sight Reading Techiniques" as used in basal readers have largely failed to eliminate reading failure in our school systems.

COMPLETE MULTI-MODALITY ANALYSIS OF TOTAL READING, WRITING, SPELLING AND LANGUA

(From: Bannatyne   System: Reading, Writing, Spelling and Language P

MEMORY AND COORDINATION PROCESSES
Arrows below indicate memory links or associations. There is No Visual Sequencing. Vertical arrows also indicate cross sensory-motor coordination.

VOCAL LANGUAGE	ARTICULEMES (Spoken, Vocal Expressive Output)	(k) → (o) → (f)
		↕ ↕ ↕
KEY BASIC LANGUAGE PROCESS	PHONEMES (Heard, Auditory Receptive Input)	/k/ → /o/ → /f/
		↕ ↕ ↕
READING	OPTEMES (Seen, Visual Receptive Input)	"c" "ou" "gh"
		↕ ↕ ↕
WRITTEN SPELLING AND WRITING AND TRACING	GRAPHEMES (Manual, Motor Output and Kinesthetic Input)	c → ou → gh

NOTE: The individual letter shapes (configurations) c, u, g, h, in the last two rows (optemes already been taught in our Reading Program as single letter optemes and graphe they are now taught as digraphs (two-letter unit designs).

30

: Bannatyne System: Reading, Writing, Spelling and Language Program 1975)

MEMORY AND COORDINATION PROCESSES
Arrows below indicate memory links or associations. There is No Visual Sequencing. Vertical arrows also indicate cross sensory-motor coordination.

Sensory Motor Processes

TICULEMES
poken, Vocal
xpressive Output)

(k) → (o) → (f)

- Identify each articuleme
- Discriminate each articuleme
- Sequence articulemes
- Split-up articulemes in words
- Sound blend articulemes in words

↕ ↕ ↕

ONEMES
eard, Auditory
eceptive Input)

/k/ → /o/ → /f/

- Aud. Identification of phonemes
- Aud. Discrimination of phonemes
- Aud. Sequencing memory for phoneme
- Aud. Closure on phonemes in words

↕ ↕ ↕

TEMES
een, Visual
eceptive Input)

"c" "ou" "gh"

- Identify unit design optemes
- Discriminate unit design optemes
- Associate in memory phoneme-to-opteme

(No visual sequencing)

↕ ↕ ↕

APHEMES
anual, Motor Output
d Kinesthetic Input)

c → ou → gh

- Identify each grapheme
- Discriminate each grapheme
- Associate grapheme-to-phoneme
- Sequence graphemes in words

shapes (configurations) 6, u, g, h, in the last two rows (optemes and graphemes) would have n our Reading Program as single letter optemes and graphemes. Here in the word "cough" digraphs (two-letter unit designs).

In my own research with Wichiarajote three correlations were significant. These were sound blending, balancing on one leg and an accurate memory for single (unit) designs. The significant sound blending correlation once again confirms the importance of the auditory-vocal modality, this time, in spelling. The ability to maintain balance is a maturational motor control skill, so once again we can also confirm the importance of motor maturation to spelling (and presumably reading). That an efficient unit design memory is important to the acquisition of spelling and reading makes considerable sense when one realizes that children must visually and motorically recognize and recall the individual letter-shapes (graphemes) in printed and written words.

Where then does the sequencing in words come from? As will be seen below there is a large amount of research evidence that auditory sequencing memory (input) and sound blending (output) are significantly correlated with achievement in reading. Therefore the above negative evidence for visual sequencing memory and the positive evidence (above and below) for auditory-vocal sequencing memory makes it almost certain that the basic sequencing functions in both reading and written spelling come from the auditory-vocal modality (especially memory functions). Since auditory-vocal sequencing memory skills are the fundamental component of the natural spoken and heard language, it is not surprising they supply the fundamental sequencing component in coding and decoding that language.

In Diagram One I have constructed a research-based model for language processing on four levels. The term "articuleme" comes from Luria to indicate spoken sounds. I personally invented the term "opteme" (Bannatyne, 1973) in order to distinguish visual letter shapes from hand-written motor/kinesthetic ones. While the diagram is largely self-explanatory please note the lack of visual sequencing arrows at the opteme level. It would seem that the auditory-vocal "phonemic computer" as it sequences sounds in the normal processing of language "blips down" (when the coding and decoding processes of written spelling and reading are operating) to "pull out" the individual optemes (letter-shapes), each as a separate unit.

The arrows on the grapheme level indicate the importance of motor-kinesthetic sequencing skills in handwriting.

Kema (1974) in a research on Dutch children in The Netherlands found a significant correlation of over +0.6 between success on written spelling and sound blending skills. So, yet again, the importance of sound blending, in this case to coding, is confirmed.

In an interesting study on adult prison inmates, Kirby, Lyle and Amble (1972), investigated reading and psycholinguistic processes in inmate problem readers. Twentyfour illiterate prisoners were given the ITPA with the result that only five out of the twelve subtests were found to be related to reading. The five relevant subtests were Auditory Reception, Auditory Association, Auditory Closure, Sound Blending, and Grammatic Closure. So while auditory vocal processes are once again significant to reading, visual processes are not, including visual sequencing memory. In a paper entitled "WISC subtest scores of disabled readers; a review with respect to Bannatyne's recategorization." Rugel (1974a) reanalyzed 25 research studies of the WISC in terms of my own recategorization of the subtest scaled scores into Spatial Ability, Conceptualizing Ability, and Sequencing Skills. Rugel concluded from these 25 researches that, "The data from the populations of disabled readers indicates that disabled readers receive their highest scores in the Spatial Category, intermediate scores in the Conceptual Category, and their lowest scores in the Sequential Category." The author goes on to say "These findings agree with Bannatyne's findings with genetic dyslexics" (SCLD). Rugel then states that "In the Spatial Category disabled readers appear to be superior to normal readers . . . in the Sequential Category disabled readers showed a clear deficit with a respect to normal readers. . . the less severe deficit shown by disabled readers on the Conceptualizing Category subtests, particularly the vocabulary subtest, suggests . . . difficulty with language skills." While the fact that disabled readers are superior to normal readers in spatial ability, (Picture Completion plus Block Design plus Object Assembly Scaled Scores) on a composite analysis of 25 separate WISC research studies, confirms my (Bannatyne, 1966a, b) hypothesis about <u>the spatial superiority of most learning disabled readers</u>, the main value of Rugel's paper is his finding that Sequential Skills (Arithmetic plus Digit Span plus Coding Scaled Scores) is their main deficit area. In another paper by Rugel (1974b) he analyzed the factor structure of the WISC in 2 populations of disabled readers. Rugel's research confirmed the separate factorial unities of my two WISC categories of Spatial Ability and Conceptualizing Ability. However, he also found an interesting bipolar relationship between Picture Completion and Coding in that those doing well on the former tend to do poorly on the latter. Another unusual finding was that the Digit Span subtest (auditory sequencing memory) did not significantly load on any particular factor/category in two of three separate researches involving the factor analysis of the WISC on populations of learning disabled children. In other words, <u>auditory sequencing memory</u> (Digit Span) tends to be a <u>unique</u> characteristic in learning disabled readers. It is also the WISC subtest in which disabled readers do most poorly (Rugel, 1974a). Incidentally, Rugel also found that the Picture Completion subtest was most often the highest WISC subtest score of disabled readers.

THE INCIDENCE OF SPATIALLY COMPETENT LEARNING DISABILITY CHILDREN IN SCHOOL SYSTEMS

The research evidence presented below indicates that in any school system between 60 and 80 percent of the learning disability children (excluding the socially disadvantaged) will be of the spatially competent type.

In a research David Moseley and I did into the incidence of spatial ability in LD children (Bannatyne, 1966 b) I reported that 70% of the sample of learning disabled readers from a school system had WISC Spatial Ability scores greater than their Conceptualizing and Sequencing scores. That particular research was done in England but similar results were obtained in California by Maxine Smith (1970). She found that "Two hundred and two (67.33%) fulfilled Bannatyne's genetic dyslexia criteria. They showed strength in spatial ability and in spatial organization, they were lower in symbol manipulation than in spatial organization and they were also deficit in sequencing. Deficits were seen in some or all language areas (i.e. verbal comprehension, conceptual ability). A second, quite different, pattern was seen in 44 cases (14.66%). These showed deficits in spatial organization and/or spatial ability, and/or perceptual organization. Visual-Motor-Coordination deficits were also frequent. Low Block Design, Object Assembly, Picture Arrangement, and Coding were observable. Fiftyfour individuals (18%) did not fit into either of the first two categories, but appeared to be a mixture of the two."

If we accept Birch's criterion (that 0 or 1 pregnancy and/or perinatal abnormality are not usually indicative of possible neurological dysfunction) and apply it to Hoffman's (1971) data, we find that 87% of the students failing in reading are neurologicaly (in this respect) "in the clear." Remember too, that 70% of Hoffman's failing students had slow or abnormal speech develoopment, a maturational factor. The two sets of figures presented in this and the preceding paragraph confirm each other in a complementary way in that approximately 70% of disabled readers are spatially competent, do not have more than one perinatal neurological impairment sign , and yet may have a maturational lag in speech.

Rugel (1973) reports that within populations of disabled learners the percentage of subjects whose Picture Completion scores were greater than their Coding scores was in the range 65% to 80%. So, yet again, it would appear that Spatially Competent Learning Disabled form by far the largest group in the total learning disabled school population. Please note that hospital schools, neurologist-selected samples of children, and other specially selected clinical populations of learning disabled children may have quite different proportional incidence figures to the ones given above, which refer to school district populations.

There has been, and still is a great need for a nationwide demographic research study which would meaningfuly cluster the various types of learning disability characteristics of children into homogeneous and mixed groups.

THE IMPLICATIONS FOR PREVENTION AND DIAGNOSIS OF LEARNING DISABILITIES

All the significant elements or characteristics of learning disabled children mentioned in this paper up to this point have been assembled as a two-stage screening and diagnostic test instrument for use with children aged four through six years (Bannatyne, 1975a). These Early Screening and Diagnostic Tests should be useful for screening children in nursery schools, kindergarten and first grade. They offer the diagnostician and learning disability teacher a profile of the most important research-based tests associated with learning disabilities, and they could contribute to studies of the incidence of types of L.D. characteristics.

RESEARCH INTO THE EFFECTIVENESS OF REMEDIATION

The failure of visual perception training programs and of Kephart types of programs has already been documented earlier in this paper. It would certainly seem almost self-evident that the use of visual perceptual training programs to help visual-spatially competent children would be a waste of time, even though some few MND children with real visual processing deficits might profit academically from such a training.

Bannatyne, M., and Bannatyne, A., (1973) reported a significant improvement in an experimental group of young learning disabled children using a Body Image/Communication Program which adds numerous language codes to developmental psycho-physical exercises. Research by Luria (1961) has determined the importance of instructional language in the development of voluntary movement.

Tactile Techniques For Letter Learning and Recognition

Baker and Rafkin (1973) in an investigation of sensory integration in the learning disabled found that, "The results of this experiment show clearly that vision is superior to touch in letter learning and recognition." Note that Baker and Rafkin set out only to compare the visual with the tactile and the results indicate that when teaching children unit letter designs they need not use tactile techniques.

Of course, this research in no way contradicts the importance of auditory-vocal techniques when teaching children to read, write and spell.

Training Pre-Readers in Auditory Analysis Skills

Rosner (1974) found that he was able to teach auditory analysis skills to young inner city children quite successfully. He says, "This paper supports the arguments that it is feasible to teach auditory analysis skills well in advance of reading instruction, thus dealing effectively with at least one aptitude that is closely related to reading achievement." This is a gratifying result but I would go one step further and suggest that the auditory skills training was coalesced with a beginning training in reading, writing, spelling and language, the results might be even better. (Bannatyne, A. and Bannatyne,M. 1975).

Teaching Letter Names and The Alphabet

Samuels (1971) reports the results of two studies which indicate that letter-name knowledge does not facilitate learning to read words made up of the same letters. He then says, "There is evidence that letter-sound training does have a positive effective." In other words, teaching the sounds of letter shapes, that is, training children in phoneme-to-grapheme association is beneficial, but the teaching letter-names is not.

Samuel's findings have been confirmed by Silberberg and Iverson (1972). These authors found that special kindergarten training in the alphabet and numbers had no discernable effect upon the end-of-first-year-reading achievement.

In concluding this section it is important to mention that Chall (1967), having summarized most of the important reading research over the previous fifty years, came to the conclusion that code-breaking techniques of teaching reading were, in general, superior to others. In this respect, our own program Bannatyne A. and Bannatyne M. (Revised 1975) is a multi-sensory, code-breaking program for teaching reading, writing, spelling and language.

37

Tutoring Learning Disability Children Versus Small Group Instruction

Very little research has been done in this area. In a research investigating one-to-one process analysis (Bannatyne et.al. 1970) we found that the single most important factors conducive to academic success in a tutorial situation were the positive statements and actions the teacher made toward the child. In other words a strong positive relationship and positive communications account for a lot of the variance in successful remediation.

More recently, Jenkins, Maynall, Peschka and Jenkins (1974) carried out a reseach comparing small group and tutorial instruction in resource rooms. Their major conclusion stated that, "The results of the preceding studies demonstrate the superiority of tutorial over small group instruction. This effect was demonstrated with different resource teachers and children in several schools across several learning tasks, word recognition, spelling,oral reading, and the acquisition of number facts . . . in natural school settings." In another paper I have argued (Bannatyne, 1975b) that one-to-one tutorial instruction has many financial, educational and social advantages over the traditional learning disability class or small group method of teaching.

Throughout this paper it has become apparent that in my previous research and earlier writings I did not give enough attention to motor maturation problems and therefore it would now seem pertinent to describe very briefly the techniques we use to enhance motor development in each of its aspects. Eye muscle tracking training and control are built into the Bannatyne System: Reading, Writing and Spelling Program (1975) so that the training occurs more or less automatically. Hand motor control is developed through motor kinesthetic tracing and handwriting in the same program; articulation is also trained there. Voluntary movement and many of the auditory-vocal memory components of language are taught through the Body Image/Communication Program (Bannatyne, M. and Bannatyne, A, 1973).

Articuleme to Phoneme to Opteme to Grapheme Training (see Diagram I)

There has been very little research on the effectiveness of articuleme-phoneme-opteme-grapheme association in memory training across modalities, but it has the potential, along with sound blending, of being a most powerful technique in the teaching of beginning reading. There is an opportunity for much more research in this area.

CONCLUSIONS

Almost all the statements I have made about Spatially Competent (genetic dyslexic) Learning Disability children in 1966 and 1971 have received unequivocal support from the research results surveyed in this paper. It would seem that SCLD children make up between 60% and 80% of the learning disability children in our school communities. This group tends to have auditory-vocal deficits especially in memory associations. In terms of maturation these tend to effect speech and language developmeent. Previously, I had not realized that many SCLD children are also "hyperactive" in regular or LD classrooms or that this characteristic (like most of the others) is, in most cases, inherited.

Conclusions About The Specific Deficits of Learning Disability Children

We can summarize the research evidence presented thus far by stating that most learning disability children have an inherited superior spatial ability which, while it is useful for the identification of unit optemes, cannot be utilized in sequencing processes because visual sequencing memory is of no importance in reading, spelling or writing. On the other hand the evidence indicates strongly that auditory-vocal skills such as sound blending, auditory sequencing memory, syntactical skills, morphology, grammatic closure, auditory reception and auditory association are key factors in efficient reading, spelling and writing. These deficit skills, the evidence suggests, most likely stem from a maturational lag, especially in the area of speech and language development, which is itself inherited.

There is strong evidence in this paper and previously (Bannatyne, 1971) that the inherited disability is also associated with hemispheric lateralization, right hemisphere spatial competence, left visual field dominance and three dimensional scanning of the environment.

I would again speculate that eventually Bender (1951), although she does not specifically mention SCLD children, will be found to be right when she suggested from her research that most specific reading disabilities are the result of a maturational/developmental lag, (program cause). This may be biochemical in origin with possibly an ACh/ChE inbalance at the synapses (Smith and Carrigan, 1959). However, on the basis of recent work on the neurological bases of memory by John (1975) neural firing patterns in the reticular formation combined with biochemical protein synthesis are the likely basis of memory recall. Perhaps slower development in the formation of glial cells and the myelination of the neuronal fibers may cause these areas and processes to work less efficiently (material causes), especially in terms of auditory memory and motor functions in SCLD children. I have frequently suggested that most such maturational lags and biochemical factors are at the lower end of a normal inheritance pattern (original, efficient cause), which is only apparent in those countries which code phonetic (especially irregular) languages under a law of compulsory literacy (the final cause). These causes and many other aspects of language, reading and learning disabilities are described in considerable detail in Bannatyne (1971).

REFERENCES

Anderson, R. P., Halcomb, C.G. and Doyle, R.B. (1973): The measurement of attentional deficits. Exceptional Children, Apr.

Baker, Georgia P. and Rasking, L. (1973) Sensory integration in the learning disabled. J. of Learning Dis. Vol.6, No.10 Dec.

Bakwin, Harry (1973): Reading disability in twins. Develop.Med.Child Neurol 15, (2), 184 to 187

Bannatyne, A.D. (1966a): Verbal and spatial abilities and reading. In: Reading Instruction: An International Forum. Newark, Delaware, International Reading Association.

Bannatyne, A.D. (1966b): The etiology of dyslexia. In: International Approach to Learning Disabilities (ACLD) San Rafael, Calif.,Academic Therapy Publications.

Bannatyne, A.D. (1971): Language, Reading and Learning Disabilities. Springfield, Ill. Charles C. Thomas, Pub.

Bannatyne, A.D. (1973): Reading: An Auditory Vocal Process, San Rafael, Ca. Academic Therapy Pub.

Bannatyne, A. D. (1975a): Bannatyne System: Early Screening and Diagnostic Tests. Lafayette, Louisiana, Learning Systems Press, (P.O. Box 2999, 70501)

stet)

Bannatyne, A. D. (1975b): Why one-to-one tutoring solves many educational problems in traditional (and other) schools and school districts. J. of Learning Dis. (in press).

Bannatyne, A. D. and Bannatyne, M. (1975): Bannatyne System: A Reading, Writing, Spelling and Language Program. Lafayette, Louisiana, Learning Systems Press, (P.O.Box 2999, 70501)

stet)

Bannatyne, M. and Bannatyne, A. (1973): Body Image/Communication Program, South Miami, Fla., Learning Systems Press, (P.O.Box 90, 33143)

stet)

Bannatyne, A.D., Solomon, M., and Phillips, S.(1970): One-to-one process analysis of Learning Disability Tutorial Sessions: Parts I,II, and III.

J. of Learning Disabilities, Sept, Oct and Nov.

Barr, K. L. and McDowell, R.L. (1972): Comparison of Learning disabled and emotionally disturbed children on three deviant classroom behaviors. Exceptional Children, September.

Belmont, I ., Flegenheimer, H., and Birch, Herbert (1973): Comparison of perceptual training and remedial instruction for poor beginning readers. J. of Learning Disabilities, Vol.1, No.4, April.

Bender, L. (1951): Research studies from Bellvue Hospital on specific reading disabilities. Bull. Orton Soc.Vol.1, June, 3-5

Bender, L. (1957): Specific reading disability as a maturational lag. Bull.Orton Soc.Vol.7, 9-18.

Black, F.W. (1973): Neurological Dysfunction and Reading Disorders. J. of Learning Dis. Vol.6, No.5, May.

Bortner, M., Hertzig, M., and Birch, H. (1972): Neurological signs and intelligence in brain damaged children. J. Spec.Educ., Vol.6, No.4, 325-333.

Bryan, T.S. (1974): An observational analysis of classroom behaviors of children with learning disabilities. J. of Learning Dis. Vo.7, No.1, Jan.

Buckland, P. and Balow, B. (1973): Effect of visual perceptual training on reading achievement. Exceptional Children, January.

Budoff, M. and Quinlan, D. (1964a): Auditory and visual learning in primary grade children. Child Development, 35, 583-586

Budoff, M., and Quinlan, D. (1964b): Reading progress as related to efficiency of visual and aural learning in the primary grades. J.Educ. Psychol.,55, 247-252

Bullock, L.M. and Brown, R.K. (1972): Behavioral dimensions of emotionally disturbed children. Exceptional Children, May, 740-741

Clements, S. (1966): Minimal brain dysfunctions: identification and terminology NINBD Monograph No.3, Public Health Service Pub. No.1415

Dykman, R. A., Peters, J. and Ackerman (1973): Experimental approaches to the study of minimal brain dysfunctions: A follow-up study. Annals of the New York Academy of Sciences. Vol. 205, 93-108

Estes, R. E. and Huizinga, R.J. (1974): A comparison of visual and auditory presentations of a paired associate learning task with learning disabled children. J. of Learning Dis. Vol.7, No.1, Jan.

Greer, B.G. and Whitley, C. (1971): The relationship between birth order and learning disabilities. Excep. Children, 37, 608.

Hare, E. H. and Price, J.S. (1969): Birth order and family size: Bias caused by changes in birth rate. Brit. J. of Psychiatry, 115, 647-657.

Hartlage, L.C. and Green, J.B. (1971): EEG differences in children's reading spelling and arithmetic abilities. Perc. and Mot. Skills. Vol. 32, No.1 133-134

Heriot, James T. (1973): Attention, Short term memory as learning requisites. World Medical Reports, Pediatric News, Vol.7, No.11, Nov.

Hoffman, Mary S. (1971): Early indications of learning problems. Academic Therapy Vol.7, No.1, Fall.

Ingram, T.T.S. (1960): Pediatric Aspects of Cerebral Palsy, Edinburgh, Livingstone.

Jenkins, T., Mayhall, W. Peschka, C. and Jenkins, L. (1974): Comparing small group and tutorial instruction in resource rooms. Except. Children, Jan.

John, E.R., (1975): Memory: Nerve firing patterns. Science News, Feb 8, 83.

Jordan, Brian T. (1973): Jordan Left-Right Reversal Test. San Rafael,Calif. Academic Therapy Pub.

Kema, G.N. (1974): Sound Blending and Spelling. (Personal Communication of research at Univ. of Groningen, The Netherlands)

Keogh, Barbara K. (1971): Hyperactivity and learning disorders: Review and speculation. Except.Children, Oct.

Kirby, E., Lyle, W., Amble, B. (1972): Reading and psycholinguistic processes in inmate problem readers. J. of Learning Dis. Vol.5,No.5 May.

Krippner, S., Silverman, R., Cavello,M. and Healy, M. (1973): A study of "hyperkinetic" children receiving stimulant drugs. Academic Therapy, Spring.

LaDriere, LaV. and Hall, L. (1973): Figure-ground discrimination and figural closure among brain-damaged children. Perc. and Mot.Skills 36, 515-520

Loe, D. C. (1973): Paired associate performance of learning disabled boys as a function of stimulus modality and elaboration. Unpublished doctoral dissertation. Univ. of Southern Calif. 1973.

Luria, A. R. (1961): The genesis of voluntary movements. Voprosy Psikhologii No.6 pp 3-19

Marwit, S.J., and Stenner, A.J. (1972):Hyperknesis: Delineation of Two patterns Excep.Children. Jan.

Matheny, A.P. and Dolan, A.B. (1974): A twin study of genetic influences in reading achievement. J.of Learning Disb., Vol2, No.2, Feb.

McKeever, W.F. and Gill, K.M. (1972): Visual half-field differences in masking effects for sequential letter stimuli in the right and left handed. Neuropsychologia (Pergamon Press) 10, 111 to 117

Nall, Angie (1973): Alpha training and the hyperkinetic child - - is it effective? Academic Therapy, Fall

Newcomer, P. and Hammill, D. (1973): Visual perception of motor impaired children: implications for assessment. Except.Children, January.

Norfleet, Mary (1973): The Bender Gestalt as a group screening instrument for first grade reading potential. J. of Learning Dis. Vol.6,No.6, June/July

Oliphant, Genevieve,(1970): A study of factors involved in early identification of specific language disability. Bull.Orton Soc. Vo.20, 81-94

Orlando, C.P. (1973): Measures of handedness as indicators of language lateralization Bull.Orton.Soc.

Otto, W. (1961): The acquisition and retention of paired-associates by good, average and poor readers. J. of Educ.Psychol., 52, 241-248

Rees, A.H. and Palmer, F.H. (1970): Factors related to change in mental test performance. Devel.Psychol., 3, II, 2, 43-45

Rosner, J. (1974): Auditory analysis training with prereaders. The Reading Teacher, Jan.

Rugel, Robert P. (1974a): WISC Subtest scores of disabled readers: A review with respect to Bannatyne's recategorization. J.of Learn.Disb.Vol.7,No.1,Jan.

Rugel, Robert P.(1974b): The factor structure of the WISC in two populations of disabled readers. J.of Learn.Disb. Vol.7.No.9, Nov.

Rugel, R.P. and Gregory, D.J. (1975): The incidence of family histories of reading disorders and of pregnancy and birth complications in learning disabled children. J. of School Psychology (In Press).

Samuels, S.J. (1971): Letter-name versus letter-sound knowledge in learning to read. The Reading Teacher, April

Satz, Paul and Friel, J.(1974): Some predictive antecedents of specific reading disability: A preliminary two-year followup. J.of Learn.Dis.Vol.7,No.7, Aug/Sept.

Schwartz, T.H. and Bryan, J.H. (1971): Imitation and judgments of children with language deficits. Except.Child., Oct.

Shields, D. T. (1973): Brain responses to stimuli in disorders of information processing. J.of Learn.Dis., Vol.6, No.7, Oct.

Silberberg,N., Silberberg,M. and Iverson,I.(1972): The effects of kindergarten instruction in alphabet and numbers on first grade reading. J.Learn.Dis. Vo.5, No.5 May.

Smith, D.E.P. and Carrigan (1959): The Nature of Reading Disability,New York,Harcourt.

Smith, Maxine (1970): Patterns of Intellectual Abilities in Educationally Handicapped Children. Ph.D. Dissertation,Claremont Graduate School,Claremont,Calif.

Steiner, Sharon (1969): Comparison of high and low achieving readers on certain basic visual functions. Unpublished masters thesis,Univ. of Illinois, Urbana.

Tarver, S.G. and Hallahan, D.P. (1974): Attention deficits in children with learning disabilities: A review. J.of Learn.Dis. Vol.7, No.9, Nov.

Vallett, R.E.(1974): The Psychoeducational Treatment of Hyperactive Children, Belmont, Calif., Fearon Publishers, 6 Davis Drive.

Vandenberg, Steven G. (1969): Human behavior genetics: present status and suggestions for future research. Merr. P. Quart. of Behav. and Dev. 16(1)

Vellutino,F.R., Pruzek, R.M., Steger,J.A. and Meshoulam, U. (1973): Immediate visual recall in poor and normal readers as a function of orthographic-linguistic familiarity. Cortex, Vol.9, No.4, 370-385

Vockell, E.L., and Bennett, B. (1972): Birth order, sex of siblings, and incidence of learning disabilities. Except.Children, Oct.

Vogel, S.A. (1974): Syntactic abilities in normal and dyslexic children. J. of Learn.Dis., Vol.7, No.2 Feb.

Wiig,E.H., Semel, E.M. and Crouse, M.(1973): The use of English morphology by high risk and learning disabled children. *J.of Learn.Dis.* Vol.6,No.7 Aug/Sept.

Wilborn, B.L. and Smith, D.A. (1974): Early identification of children with learning problems. *Academic Therapy*, Vol.9, No.5, Spring.