A DESCRIPTIVE STUDY OF SELECTED PHYSICAL, DEVELOPMENTAL AND TEST SCORE DATA ON A GROUP OF MINIMALLY BRAIN-INJURED CHILDREN

A Thesis Presented to the
Faculty of the Department of Psychology of the
University of Houston

In Partial Fulfillment of the
Requirements for the Degree of Master of Arts

by
Geneva Deptris Adair

August, 1967

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ABSTRACT

The purpose of this study was to determine the physical and mental characteristics common to those children who have been diagnosed as having minimal cerebral dysfunction, or who are more commonly referred to as minimally brain-injured. This term is restricted to those children who are near average, average or above average in intelligence and who evidence learning disabilities which are associated with deficiencies of function in the central nervous system. It does not include the multiple-handicapped child, i.e., the child with cerebral dysfunction who is also blind, deaf and/or orthopedically handicapped.

Diagnosis of minimally brain-injured children is often complicated by the emotional overlay prominent in such cases as well as the lack of obvious physical signs of neurological involvement. The task becomes one of detecting disturbances in integrative capacity, often the only clue to organicity.

The sample group for the study was composed of sixty elementary age children from a large metropolitan school district. These children had been diagnosed as minimally brain-injured on the basis of medical evidence,

school history and learning disabilities as revealed by the Wechsler or Binet test protocol. The children had been placed or were awaiting placement in classes for the minimally brain-injured.

The variables included in this study were grouped as: 1) physical factors, including pre-, para-, and postnatal history, 2) developmental, including behavior characteristics and 3) test data. The pertinent details related to 1) and 2) were secured through examination of parent interview forms and medical evaluations submitted by doctors. The test data were secured from Wechsler and Binet protocols administered by qualified psychologists.

Thirty Stanford-Binet protocols were appraised in terms of mental age, basal age and the level at which ceiling was established. Five subtests were selected as representative measures of abilities found lacking or confused in the brain-injured children. These were: Patience at Year V, Number Concepts and Mazes at Year VI, and Diamond and Digits at Year VII.

All scaled scores of the Wechsler Intelligence Scale for Children were included as variables, with the exception of Digit Span which was not administered in the majority of cases. The Verbal, Performance and

Full Scale scores were also included as separate variables.

The analysis of the data of this study seems to justify the following conclusions: There is a greater percentage of males evidencing minimal cerebral dysfunction, seventy-five percent male as compared with twenty-five percent female. Of all physical factors, birth trauma was reported most frequently. Sixty-two percent of the children were first or second born, with more (thirty-seven percent) in the second born classification.

In analysis of physical characteristics, the brain-injured child was more often poor in fine coordination than in the gross. Language problems were reported in approximately half the group. Late developmental milestones were not characteristic of this sample. Strauss syndrome characteristics were reported in eighty-eight percent of the cases.

Test data indicate difficulty was encountered with measures of perceptual-motor skills, auditory memory and attention span. Long test scatter was not evident on the Binet; however, intertest variability on the Wechsler was characteristic of the sample.

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CHAPTER I

THE PROBLEM

Statement of the Problem:

This study is concerned with the problem of determining the physical and mental characteristics common to those children who have been diagnosed as having minimal cerebral dysfunction or who are more commonly referred to as minimally brain-injured. This term refers to those children who are near average, average or above average in intelligence and who evidence learning disabilities which are associated with deficiencies of function in the central nervous system. Possible causative factors of such neurological impairment are myriad, as are the various expressions of such impairment in specific learning disabilities and behavior problems. Identification of such children is primarily on the basis of these disabilities which make functioning within the regular classroom environment difficult. Diagnosis is often complicated by the emotional overlay prominent in such cases.

Minimal cerebral dysfunction does not include the multiple handicapped child; i.e., the child with

cerebral dysfunction who is also blind, deaf and/or orthopedically handicapped. Therefore, obvious physical signs of neurological involvement are often lacking and the task becomes one of detecting disturbances in integrative capacity, often the only clue to organicity. The diagnostic problems and educational challenges presented by these children differentiate them from the retarded and the typical slow learner.

Need for Study:

Studies at Northwestern University indicate that as high as eight percent of the school population falls within the category of children having specific learning disabilities which make progress within the regular classroom difficult. There is an increased awareness of the need for refined techniques in identification as well as educational adjustments tailored to the specific deficits revealed by psychological assessments. Although the literature of the past twenty years abounds with individual studies and descriptions of these children, little has been done in the analysis of common characteristics revealed by group studies. The concept of brain dysfunction

has received increasing attention in the past twenty years. However, we are still in the pioneer stages so far as precise classification of such learning disorders and statistical data pertaining to such children are concerned.[1] Available data pertaining to minimal brain dysfunction has been largely restricted to adult disorders which involve variance from established behavior. These would be inappropriate in the case of brain dysfunction in children whose problem is one of disturbance in the neuropsychological development. It is hoped that the data gathered in this study will contribute toward a better understanding of these deviating children.

Limitation of Study:

The limitations of the study necessarily involve the small sample group as well as questionable accuracy of the physical data. The details of the prenatal and early physical history are dependent on the memory and the sophistication of the parent in cognizance of possible pertinent

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[1]Sam D. Clements, "Minimal Brain Dysfunction in Children," U.S. Department of Health, Education and Welfare, (1966).

factors. The interviewer's skill in securing all possible pertinent data is also involved. A standard interview form was used for all parent interviews. The psychological assessments, all administered by qualified psychologists, might also be questioned due to the known lability of behavior evidenced by children with minimal cerebral dysfunction. Performance during such evaluative sessions is also influenced by whether or not the child is on medication at the time. This study is approached with the assumption that the children included are, in fact, accurately diagnosed as minimally brain injured.

CHAPTER II

SURVEY OF THE LITERATURE

Historians credit the nineteenth century educators, Itard, Seguin and Guggenbuehl with early major contributions toward the understanding of mental defects. Toward the end of the nineteenth century, the introduction of the Binet Intelligence Scale led to differentiation of the normal pupil from the mentally deficient. However, beyond this gross differentiation, Binet and Simon did suggest a division in types of mental defective children.

> ". . . the division, which we have ourselves suggested, of all the abnormal into three groups: 1) the mentally defective, 2) the ill-balanced, 3) a mixed type which includes those who are both deficient and ill-balanced. The simply defective do not present any well defined anomaly of character, but they do not profit, or profit very little from the ordinary school teaching. The ill-balanced, who might also be called the 'undisciplined,' are abnormal chiefly in character. They are distinguished by their unruliness, their talkativeness, their lack of attention and sometimes their wickedness."[2]

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[2]A. Binet and Simon, Th.: Mentally Defective Children. Translated by W.B. Drummond. London: Edward Arnold, (1914) p. 179.

The clinical picture of the brain-injured child fits the Binet description of the "ill-balanced." However, through the early part of the twentieth century, the group labeled as "mentally retarded" remained a homogenous group. The behavior variations and individual responses to educational methods led to further study.

Medical science had also made contributions to the field in the discovery of localization of certain cerebral functions. The work of the French anatomist, Broca in 1861 presented proof that a lesion located in a very particular part of the brain (third frontal gyrus) affected the expressive language or motor speech.[3] Research from that point increased significantly. It was learned that other functions of movement and sensation were innervated from definite areas of the brain.

This discussion of localization led to the identification of "traumatic dementia" in adults. Head and Goldstein studied young soldiers who had

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[3]A. Strauss and L. Lehtinen, Psychopathology and Education of the Brain-Injured Child, Grune & Stratton, Inc., (1947).

sustained head injuries during World War I and noted the loss of ability and aberrations of behavior evidenced. These characteristics differed from those observed in simple amentia or senile dementia. In time, the study of the traumatic brain-injured adult led to identification of children with similar psychopathological symptoms. However, with the adult, the problem was one of lost skills and abilities once possessed; whereas, with the children it was of thwarted acquisition of certain skills due to injuries believed sustained at various stages of development. Siegel states that seventy percent of brain-injury in children is para-natal (occurring at birth).[4]

One serious problem encountered with many of these children was disturbance in the perceptual areas. Perception is described as that process which gives meaning to given sensations: auditory, visual and tactual. Visual perception is acknowledged as one of the prime psychological functions. This is the ability to correlate stimuli with past

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[4] Ernest Siegel, Helping the Brain-Injured Child, New York Asscciation for Brain-Injured Children (1962).

and present experience. This integration and interpretation takes place in the brain. Although the receptive organ may be perfect, there can be malfunctioning when the image reaches the brain itself.

In the analysis of visual perception, there seems to be five different levels of development which must be fully developed to reach maximum visual perceptual development. These as outlined by Frostig[5] are as follows:

> 1) Perception of position in space or perception of relationship of an object to the observer. Spatially at least, the person is always the center of his own worls.
>
> 2) Perception of spatial relationships or ability to perceive two or more objects out in space in relation to oneself and in relation to each other.
>
> 3) Perceptual constancy or ability to perceive an object as possessing invariant properties such as position, shape and size in spite of the variability of the impression on the sensory surface.
>
> 4) Visual-motor coordination or ability to coordinate vision with movements of the body or with movement of a part or parts of the body.

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[5] M. Frostig, "Theories on Visual Perception," Lecture by Mary Powers, (1966).

5) Figure-Ground Perception. We perceive most clearly the thing we direct our attention to most fully. From a number of stimuli, the brain selects a few which become the center of attention.

Communication in the human is said to be influenced eighty percent visually, seventeen percent auditorially, three percent by other stimuli (touch, taste, smell.) Visual perception is a learned process, evolving from every day encounters and on its development is dependent the active cognitive processes thought to be established at approximately seven and one-half to eight years of age.

On the basis of perceptions and ability to recall them as images, concept formation develops. When several images are brought together under one demoninator, we speak of formation of a concept. Experiments in ability of brain-injured children to classify infer that such children are prone to give uncommon, far-fetched and often peculiar responses. This is insightful to the thinking disorders often associated with minimal cerebral dysfunction.

The behavior deviations constitute the so-called "complaint" factor. These are manifestations of behavior which are not consistent with the chronological development of the child. The

undifferentiated motor play of the infant is viewed as retarded behavior in later years. The incessant chatter of a three-year-old is considered abnormal in verbosity in later years. Abstract conceptualization is absent in the four-year-old but expected in the third or fourth grader.[6]

An interesting study by Bradley, differentiating behavior of the schizophrenic child and the brain-injured is outlined below. It is noted that only one symptom of eight recognized as occurring in childhood schizophrenia appears in behavior disorders due to brain injures.[7]

Schizophrenia	Brain-Injured
Seclusiveness	0
Irritability when seclusion is interrupted	0
Daydreaming	Yes
Bizarre behavior	0
Diminution in number of personal interests	0

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[6]Strauss and Lehtiten, The Brain-Injured Child, Grune and Stratton, (1947).

[7]C. Bradley, "Behavior Disturbances in Epileptic Children," J.A.M.A. 146: (1951).

(continued)

Regressive nature of personal interests	0
Sensitivity to comment and criticism	0
Physical inactivity	0

The differentiation of children with neurotic or psychopathic disturbances from those with brain injury is somewhat more difficult. The table below illustrates characteristics common to both:

Psychopathic Personality	Brain-Injured
Annoying	Yes
Unstable	Yes
Unreliable	Yes
Flighty	Yes
Obsessive	0
Morally defective	0
Cruel	Yes
Deceitful	0
Irritable	Yes
Violent	Yes
Malicious	0
Impulsive	Yes
Pathological lying	0
Sexually perverted	0
Anxiety and fear	0
Hysterical body complaints	0

"Since psychopathic behavior is most probably based on innate, psychic organization, the added factor of brain injury with its additional disturbance in interaction with an already inferior personality structure results in a still more complex clinical picture."[8]

In 1966 the U.S. Department of Health and Welfare issued a bulletin regarding terminology and identification as related to minimal brain dysfunction in children. It was stated that in study of literature concerning these children, ten characteristics emerged as most frequently cited by authors. These are as follows:

1) Hyperactivity

2) Perceptual-motor impairments

3) Emotional lability

4) General coordination deficits

5) Disorders of attention, (short attention span, distractibility, perseveration.)

6) Impulsivity

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[8]Strauss and Lehtinen, The Brain-Injured Child, Grune and Stratton, (1947).

(continued)

7) Disorders of memory and thinking

8) Specific learning disabilities:
   a. Reading
   b. Arithmetic
   c. Writing
   d. Spelling

9) Disorders of speech and hearing

10) Equivocal neurological signs and electroencephalographic irregularities

It is recognized that combinations of these symptoms appear in varying degrees in the child with minimal cerebral dysfunction. Indeed, it is the fact that some of the symptoms do tend to cluster to form recognizable clinical entities and some order is salvaged by identification of hyperkinetic syndrome (excessive motor activity) and hypokinetic syndrome with primary reading retardation and in some cases, aphasia.[9]

The literature generally stresses that there is no "cookbook" approach to diagnosis or education of the brain-injured child.

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[9]Sam Clements, "Minimal Brain Dysfunction in Children," U.S. Department of Health, Education and Welfare, (1966).

CHAPTER III

The Sample Group and Variables Used

Sample Group:

The sample group of sixty elementary school children was drawn from the files of a large metropolitan school district. These children had been diagnosed as neurologically involved and were either placed or waiting to be placed in classes for children with minimal cerebral dysfunction. The children originally had been referred by the schools. They had been identified as being unable to make satisfactory progress within the regular school situation. Behavior problems were also prominent with these children.

The physical history secured through interview with the parent, the psychological evaluation and school progress were all considered before referral for a complete medical evaluation was made. Medical evidence of neurological involvement is required for placement in the brain-injured program. This evidence can be by clinical impression, abnormal electroencephalographic results or by abnormalities in reflexes revealed in the neurological examination. These data accompanied by a

psychological profile indicative of learning disabilities are presented to a Placement Committee. The Committee is composed of a medical doctor and supervisors of various special education departments. Each proposed placement is approved or disapproved on the basis of presenting evidence.

To be considered for the brain-injured classes, a child must evidence above average, average or near average intelligence. There are a number of children included in the sample who had intelligence quotients in the borderline ranges. These children had been accepted in the brain-injured program because the examiner had felt that the results of the intellectual assessment were minimal and not representative of true potential.

The sample group was differentiated by the psychological instrument used in assessment. Thirty children were selected who had been administered the Stanford-Binet Intelligence Scale, Form L-M. The mean age for these children was six years, seven months. The remaining thirty had been administered the Wechsler Intelligence Scale for Children; the mean age for these was nine years, ten months.

Variables Used:

Since brain injury encompasses any insult to the central nervous system occurring at any time following conception, pre-, para- and post-natal factors must be considered. Included among the variables selected for this study were details concerning these developmental periods as related in the parent interview. Threatened miscarriages, Rh blood factor difficulties, any serious maternal illness during the gestation period were entered as positive indicators of prenatal trauma. Sex, birth weight and birth rank were also included as variables in the study.

Under the variable "Birth Difficulties" were included unusually long labor period, precipitant birth, unusual presentation (other than cephalic), cyanosis or evidence of anoxia at birth. Mention of any of these resulted in an entry of "positive" under this variable.

During the developmental years, fevers and head trauma were selected as possible factors in brain injury. Sustained temperature elevations over extended periods were considered detrimental and any mention of such resulted in a "positive"

entry. The entry under "Head Trauma" was restricted to accidents of such severity as to be considered serious by the parent. Loss of consciousness or nausea were not experienced by all, but medical diagnosis was sought in the majority of these cases.

There is a general consensus that there is a lag in the developmental milestones of the brain-injured child. Under this variable consideration was given as to whether such developmental milestones as walking, talking and toilet training were established at the appropriate age levels. Walking within the first eighteen months, toilet trained by two- and one-half years and connected discourse established by the age of three years were considered the upper limits of normal developmental ranges. If one or more of these milestones was late, the entry under this variable was so indicated.

Any problems in motor coordination in either the gross or fine areas were noted. Parents often describe these children as "clumsy", unable to ride a bicycle, and as having problems in play activity requiring motor integration. Fine coordination as required in eating and in paper-pencil tasks may also be affected.

Language disability was included as a variable since it is felt that the brain-injured child has difficulty in developing language as a symbolism. Though he may know a large number of words, he encounters difficulty in using the words he knows. Grammatical confusions are prevalent. Under this variable, mild speech irregularities were also included.

The neurological evaluation form submitted by the medical doctor often yielded results of electroencephalographic studies; medication if prescribed, was also noted on this form. Details of the electroencephalographic studies were usually lacking and only the final diagnosis of normal or abnormal was submitted. The medical profession is divided on whether the 14-6 pattern constitutes abnormality. For this study, mention of this syndrome led to the designation of abnormal, since the existence of such a pattern is currently considered admissible evidence of neurological involvement when a case is presented to the Placement Committee. No differentiation was made as to type of medication prescribed the child. These medications were generally in the stimulant or anticonvulsive groups. The brain-injured

child is frequently known to react in an opposite to the intended effect of medication; i.e., a stimulant may act as a depressant and vice versa. Medication was usually prescribed to make the child more tractable within the home and school environment.

The Strauss Syndrome variable relates to those behavior characteristics that Alfred Strauss designated as commonly associated with some of the brain-injured children. These include hyperactivity, impulsivity, disinhibition, distractibility, perseveration and emotional lability. Any one of these or combinations of such characteristics may be evident in varying degrees in these children. Mention of such problems in the case history or school record resulted in a "positive" entry under this variable.

Each child's Binet performance was appraised in terms of mental age, basal age and the level at which ceiling was established. Five subtests were selected from the Binet Scale for particular scrutiny. These were Patience at the five-year level, Number Concepts and Mazes at level VI, and Diamond and Digits at Year VII. These particular subtests were considered as measures of abilities

found lacking or confused in the brain-injured child. Dornbäck's subtest analysis of the Binet Scale designates Patience: Rectangles as a measure of sensory-perceptual discrimination, motor coordination and imagery. Number Concepts at Year VI is a measure of ideational judgment and arithmetic reasoning. Motor coordination, practical judgment, ideational judgment and imagery are required for success on Mazes, Year VI. The successful execution of the Diamond also involves sensory and perceptual discrimination, motor coordination and imagery. Digits at Year VII measure immediate auditory memory.

All scaled scores of the Wechsler Intelligence Scale for Children were included as variables, with the exception of Digit Span which was not administered in the majority of cases. The Verbal, Performance and Full Scale scores were also considered as separate variables.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

The basic data on the sample group of sixty children in this study were classified as follows: 1) Physical data, 2) The developmental, 3) Test scores or results (Binet and Wechsler data). These basic data are presented in Tables I through IV and will be referred to in the succeeding pages of this chapter.

Physical Variables or Characteristics:

Of the sixty children involved in the study, a differentiation was made on the basis of sex. Of the sixty, forty-five were males and fifteen were females. This is a three to one ratio, or seventy-five percent male, twenty-five percent female. To determine whether this ratio held true with a larger sampling, results of an annual report of the Child Study Division of the large metropolitan school district where the sixty children were enrolled were examined. An excerpt from the report follows:

TABLE A

Number of Children Studied:					Recommendation:
Male	%	Female	%	Total	
1	50	1	50	2	Classes for the Blind
*57	84	11	16	68	Classes for the Neurologically Impaired
39	91	4	9	43	Classes for Emotionally Disturbed
36	67	18	33	54	Classes for Deaf
7	70	3	30	10	Language Development Class
4	67	2	33	6	Language Center Service
5	100	0	0	5	Speech Therapy
29	48	31	52	60	Classes for Trainable Mentally Retarded.
294	64	168	36	462	Classes for Educable Mentally Retarded
15	71	6	29	21	Classes for Orthopedically Handicapped
5	63	3	37	8	Classes for Partially Sighted
492	67%	247	33%	739	Totals

TABLE I

BASIC PHYSICAL DATA ON SAMPLE GROUP

Case No.	Sex	C.A.	Birth Rank	Birth Wgt.	Prenatal Period	Birth Difficulty	Fevers	Head Trauma
1	M	6-0	6	6-0	Neg.	Pos.	Pos.	Neg.
2	F	7-4	2	5-4	Neg.	Pos.	Neg.	Neg.
3	M	6-7	Adopt.	?	?	?	Neg.	Neg.
4	M	6-8	Adopt.	?	?	?	Pos.	Neg.
5	M	5-10	1	7-10	Pos.	Pos.	Pos.	Neg.
6	M	6-7	3	7-0	Neg.	Neg.	Pos.	Pos.
7	M	6-3	3	6-13	Neg.	Pos.	Neg.	Neg.
8	M	6-7	2	8-7	Neg.	Pos.	Neg.	Neg.
9	M	6-9	2	6-5	Pos.	Neg.	Neg.	Pos.
10	M	6-3	5	6-11	Neg.	Neg.	Neg.	Pos.
11	M	6-0	Adopt.	?	?	Pos.	Neg.	Neg.
12	F	6-8	1	7-4	Neg.	Pos.	Neg.	Pos.
13	M	6-5	2	9-1	Pos.	Pos.	Neg.	Pos.
14	M	7-5	2	6-2	Neg.	Pos.	Neg.	Neg.
15	F	6-3	3	5-4	Neg.	Neg.	Neg.	Neg.
16	M	6-0	1	?	Pos.	Pos.	Neg.	Pos.
17	M	6-6	3	6-8	Neg.	Pos.	Pos.	Neg.
18	F	9-4	2	8-3	Neg.	Neg.	Neg.	Neg.
19	M	8-3	4	5-7	Pos.	Pos.	Pos.	Neg.
20	M	8-4	4	7-13	Neg.	Neg.	Neg.	Neg.

Table I (continued)

Case No.	Sex	C.A.	Birth Rank	Birth Wgt.	Prenatal Period	Birth Difficulty	Fevers	Head Trauma
21	F	7-4	2	5-4	Neg.	Pos.	Pos.	Neg.
22	M	7-5	1	9-4	Pos.	Neg.	Pos.	Neg.
23	F	7-9	6	6-0	Neg.	Neg.	Neg.	Pos.
24	M	8-11	1	7-9	Pos.	Pos.	Pos.	Neg.
25	M	8-2	2	6-6	Pos.	Pos.	Neg.	Pos.
26	M	6-9	1	8-14	Neg.	Pos.	Neg.	Neg.
27	M	7-2	2	7-11	Pos.	Pos.	Neg.	Neg.
28	M	6-8	1	6-0	Pos.	Pos.	Pos.	Neg.
29	F	6-5	3	7-0	Neg.	Neg.	Neg.	Neg.
30	F	6-5	Adopt.	?	?	?	Neg.	Neg.
31	M	7-5	3	8-7	Neg.	Pos.	Pos.	Pos.
32	M	10-9	1	9-0	Pos.	Neg.	Pos.	Neg.
33	M	10-5	1	?	Neg.	Pos.	Pos.	Neg.
34	M	8-3	1	6-5	Neg.	Pos.	Neg.	Neg.
35	M	12-11	2	8-8	Pos.	Neg.	Neg.	Neg.
36	M	7-8	1	7-5	Neg.	Pos.	Pos.	Neg.
37	F	12-6	1	?	Neg.	Neg.	Neg.	Neg.
38	F	10-8	2	6-9	Neg.	Pos.	Neg.	Neg.
39	M	11-3	2	4-3	Pos.	Neg.	Neg.	Neg.
40	M	9-4	2	6-13	Neg.	Neg.	Pos.	Neg.
41	F	12-7	2	5-13	Pos.	Pos.	Pos.	Pos.
42	M	9-3	2	?	Neg.	Pos.	Neg.	Neg.

Table I (continued)

Case No.	Sex	C.A.	Birth Rank	Birth Wgt.	Prenatal Period	Birth Difficulty	Fevers	Head Trauma
43	M	10-9	3	7-0	Pos.	Neg.	Neg.	Neg.
44	M	9-10	2	8-13	Neg.	Pos.	Pos.	Pos.
45	M	10-4	3	9-5	Neg.	Neg.	Neg.	Pos.
46	M	9-5	2	6-9	Pos.	Pos.	Neg.	Pos.
47	F	9-11	1	9-4	Pos.	Neg.	Pos.	Neg.
48	M	8-3	2	7-8	Neg.	Neg.	Neg.	Pos.
49	F	11-3	1	7-14	Pos.	Neg.	Pos.	Neg.
50	M	7-0	2	6-10	Pos.	Neg.	Pos.	Neg.
51	F	6-6	3	9-8	Pos.	Pos.	Pos.	Neg.
52	M	11-1	2	7-0	Neg.	Pos.	Neg.	Neg.
53	M	10-9	3	7-0	Pos.	Neg.	Pos.	Neg.
54	F	9-4	Adopt.	4-15	?	?	Neg.	Neg.
55	M	8-9	2	5-0	Neg.	Pos.	Pos.	Neg.
56	M	8-0	6	7-5	Pos.	Neg.	Pos.	Neg.
57	M	9-0	2	?	Neg.	Pos.	Pos.	Neg.
58	M	10-4	1	9-6	Neg.	Pos.	Pos.	Pos.
59	M	10-4	Adopt.	5-0	?	?	Pos.	Neg.
60	M	10-4	3	6-6	Pos.	Pos.	Pos.	Pos.

TABLE II

BASIC DEVELOPMENTAL DATA ON SAMPLE GROUP

Case No.	Develop. M'stones	Coordination Fine	Coordination Gross	Language Problems	EEG	Medication	Strauss Syndrome
1	Late	Poor	Poor	Pos.	Abn.	Neg.	Neg.
2	Late	Poor	Good	Pos.	Abn.	Neg.	Pos.
3	Late	Poor	Poor	Pos.	Nor.	Pos.	Pos.
4	?	Poor	Good	Pos.	Abn.	Pos.	Pos.
5	Normal	Good	Good	Neg.	Nor.	Neg.	Pos.
6	Normal	Poor	Poor	Pos.	Abn.	Pos.	Pos.
7	?	Poor	Good	Pos.	Abn.	Pos.	Pos.
8	Late	Poor	Poor	Pos.	Abn.	Neg.	Pos.
9	Late	Poor	Good	Pos.	Nor.	Neg.	Pos.
10	Normal	Poor	Good	Pos.	Abn.	Neg.	Pos.
11	Late	?	?	Pos.	Nor.	Pos.	Pos.
12	Late	Poor	Poor	Pos.	Abn.	Pos.	Neg.
13	Normal	Poor	Poor	Neg.	Nor.	Pos.	Pos.
14	Normal	Poor	Poor	Neg.	Abn.	Neg.	Pos.
15	Normal	Good	Good	Neg.	?	?	Pos.
16	Normal	Poor	Poor	Neg.	Abn.	Pos.	Pos.
17	Normal	Poor	Poor	Neg.	Abn.	Neg.	Pos.
18	Normal	Poor	Poor	Neg.	Nor.	Neg.	Pos.
19	Normal	Poor	Poor	Neg.	Abn.	Pos.	Pos.
20	Normal	Good	Good	Neg.	Abn.	Pos.	Pos.
21	Normal	Poor	Good	Pos.	Abn.	Neg.	Pos.

Table II (continued)

Case No.	Develop. M'stones	Coordination Fine	Coordination Gross	Language Problems	EEG	Medication	Strauss Syndrome
22	Late	Poor	Poor	Pos.	Nor.	Pos.	Pos.
23	Normal	Good	Good	Neg.	?	Pos.	Neg.
24	Late	Poor	Poor	Pos.	Abn.	Pos.	Pos.
25	Late	Fair	Fair	Pos.	Abn.	Pos.	Pos.
26	Late	Poor	Poor	Pos.	Abn.	Pos.	Pos.
27	Normal	Fair	Poor	Pos.	Abn.	Pos.	Pos.
28	Normal	Poor	Poor	Neg.	Abn.	Pos.	Pos.
29	Normal	Poor	Poor	Neg.	Nor.	Neg.	Pos.
30	Normal	Poor	Poor	Neg.	Nor.	Pos.	Pos.
31	Normal	Fair	Good	Neg.	?	Pos.	Pos.
32	Normal	Good	Good	Neg.	Abn.	Pos.	Pos.
33	Normal	Poor	Poor	Neg.	Abn.	Pos.	Pos.
34	Normal	Poor	Good	Neg.	Abn.	Pos.	Pos.
35	Late	Poor	Poor	Pos.	Abn.	Neg.	Pos.
36	Normal	Poor	Good	Neg.	Nor.	Pos.	Pos.
37	Normal	Poor	Poor	Pos.	Abn.	Pos.	Pos.
38	Normal	Poor	Poor	Pos.	Abn.	Neg.	Neg.
39	Normal	Poor	Poor	Neg.	Abn.	Pos.	Pos.
40	Normal	Poor	Poor	Neg.	Nor.	Neg.	Pos.
41	Late	Poor	Poor	Pos.	Abn.	Pos.	Pos.
42	Late	Poor	Poor	Pos.	Abn.	Pos.	Pos.
43	Normal	Good	Good	Neg.	Abn.	Pos.	Pos.
44	Normal	Poor	Poor	Neg.	Abn.	Neg.	Pos.
45	Normal	Good	Poor	Neg.	?	Pos.	Pos.

Table II (continued)

Case No.	Develop. M'stones	Coordination Fine	Coordination Gross	Language Problems	EEG	Medication	Strauss Syndrome
46	Normal	Good	Good	Pos.	Abn.	Pos.	Pos.
47	Normal	Good	Good	Neg.	?	Pos.	Pos.
48	Normal	Poor	Good	Pos.	Nor.	Pos	Pos.
49	Late	Good	Good	Pos.	Abn.	Neg.	Neg.
50	Normal	Good	Good	Neg.	Abn.	Pos.	Pos.
51	Late	Poor	Poor	Pos.	Abn.	Neg.	Pos.
52	Normal	Good	Good	Pos.	Abn.	Pos.	Neg.
53	Normal	Good	Good	Neg.	Abn.	Pos.	Neg.
54	Normal	Good	Good	Neg.	Nor.	Pos.	Pos.
55	Late	Good	Good	Pos.	Nor.	Neg.	Pos.
56	Late	Poor	Poor	Pos.	Abn.	Pos.	Pos.
57	Normal	Poor	Poor	Neg.	Abn.	Pos.	Pos.
58	Normal	Good	Good	Pos.	Abn.	Pos.	Pos.
59	Late	Poor	Poor	Pos.	Nor.	Pos.	Pos.
60	Normal	Poor	Poor	Pos.	Abn.	Pos.	Pos.

TABLE III

BASIC BINET DATA ON SAMPLE GROUP

Case	C.A.	M.A.	IQ	Basal	Ceil.	Pat.	No.Con.	Mazes	Diam.	Digits
1	6-0	4-7	74	4-0	6-0	-	-	-	-	-
2	7-4	6-5	86	6-0	8-0	+	+	+	+	-
3	6-7	5-3	78	4-6	6-0	-	-	-	-	-
4	6-8	7-4	110	6-0	8-0	+	+	+	+	+
5	5-10	5-4	91	4-0	6-0	+	+	-	-	-
6	6-7	6-0	90	5-0	8-0	+	-	+	-	-
7	6-3	5-4	84	4-0	8-0	-	-	+	-	-
8	6-7	6-2	93	5-0	7-0	+	+	+	-	-
9	6-9	5-9	84	4-0	7-0	+	+	+	-	-
10	6-3	5-4	84	3-6	7-0	-	-	-	-	-
11	6-0	4-8	76	3-6	7-0	-	-	-	-	+
12	6-8	5-5	79	4-6	6-0	-	+	+	-	-
13	6-5	5-8	87	4-6	7-0	-	-	-	-	+
14	7-5	6-2	81	4-6	8-0	-	-	-	-	-
15	6-3	5-4	84	4-6	6-0	-	-	+	-	-
16	6-0	6-10	116	5-0	8-0	+	+	+	-	+
17	6-6	8-6	136	6-0	11-0	+	+	+	-	+
18	9-4	7-4	77	6-0	9-0	+	+	+	-	+
19	8-3	5-11	69	4-6	8-0	-	-	+	-	-
20	8-4	6-10	80	6-0	10-0	+	+	+	+	-
21	7-4	6-5	86	3-6	8-0	+	+	+	+	-
22	7-5	6-8	88	5-0	9-0	+	+	+	-	-

Table III (continued)

Case	C.A.	M.A.	IQ	Basal	Ceil.	Pat.	No.Con.	Mazes	Diam.	Digits
23	7-9	6-6	82	6-0	7-0	+	+	+	-	+
24	8-11	7-8	84	7-0	8-0	+	+	+	+	+
25	8-2	6-6	77	5-0	8-0	+	+	+	+	-
26	6-9	5-8	82	5-0	7-0	+	-	-	-	-
27	7-2	6-6	88	6-0	8-0	+	+	+	-	-
28	6-8	7-4	110	5-0	9-0	+	+	+	-	-
29	6-5	6-0	93	5-0	9-0	+	-	+	-	-
30	6-5	4-10	73	4-0	7-0	+	-	-	-	+

TABLE IV

BASIC WECHSLER DATA ON SAMPLE GROUP

Case	W VS	I PS	S FS	C .	Inf.	Comp.	Arith.	Sim.	Vocab.	PC	PA	BD	OA	Cod.
31	94	94	93	8	10	11	5	11	10	7	11	9	9	
32	100	100	102	11	8	14	11	9	7	13	10	11	9	
33	78	67	70	5	9	6	7	6	5	6	6	4	5	
34	87	101	93	9	9	7	7	8	12	10	11	13	5	
35	92	96	93	7	11	8	8	10	11	12	8	10	6	
36	108	79	93	11	16	12	8	9	8	8	9	7	3	
37	89	76	81	8	7	8	11	7	7	4	5	6	11	
38	87	90	88	6	8	10	11	6	5	10	10	10	8	
39	84	104	93	6	9	8	7	7	5	13	12	11	13	
40	92	92	91	7	5	10	12	10	9	7	9	10	9	
41	82	74	76	6	8	7	9	6	2	11	5	8	5	
42	87	87	86	9	6	9	6	10	12	8	7	7	7	
43	75	75	72	5	8	7	5	5	7	7	8	7	3	
44	96	97	96	9	12	8	9	9	9	11	10	11	7	
45	96	93	94	9	10	5	14	9	17	5	10	8	5	
46	97	110	104	7	11	12	8	10	10	13	11	13	10	
47	95	94	94	10	10	10	8	8	8	8	11	10	10	
48	92	93	92	5	9	7	14	9	6	10	10	13	6	
49	97	82	89	9	10	8	11	10	8	9	5	7	8	
50	101	121	112	9	12	10	7	13	16	13	9	14	13	
51	74	76	72	7	3	4	6	9	9	7	5	7	5	
52	87	89	87	6	10	8	8	8	7	8	7	11	9	

Table IV (continued)

Case	W VS	I PS	S C. FS	Inf.	Comp.	Arith.	Sim.	Vocab.	PC	PA	BD	OA	Cod.
53	77	86	80	8	7	5	6	6	9	9	6	5	11
54	90	86	87	8	9	7	10	8	8	8	9	9	6
55	85	82	83	8	6	8	10	7	11	7	7	6	6
56	90	93	91	8	9	9	6	10	9	12	9	8	7
57	81	69	73	5	10	5	5	10	6	11	7	3	1
58	121	103	114	13	12	13	15	14	14	12	10	8	8
59	79	83	79	15	6	2	4	6	9	8	7	7	7
60	87	90	88	10	6	9	9	6	6	9	10	10	8

The basic data on sex in Table A confirmed the findings of this study that more males than females were being diagnosed as brain-injured. In the annual study, the ratio was closer to six males for every female. To further substantiate this finding, the male and female distribution of the brain-injured classes within this same school system was analyzed. The total enrollment figures are given below:

Brain-Injured Elementary Age Children

Males	222	75%
Females	73	25%
Total	295	

Brain-Injured Junior High School Children

Males	44	73%
Females	16	27%
Total	60	

Brain-Injured Senior High School Children

Males	15	88%
Females	2	12%
Total	17	

Total Enrollment in the Brain-Injured Program

Males	281	75%
Females	91	25%

As can be concluded by the above figures, the ratio of three males to one female agrees with the ratio secured in the smaller sample group of this study. Though it is beyond the scope of this study, this finding leads to conjecturing as to whether the male is more easily identifiable as brain-injured or whether there is an actual constitutional vulnerability in the male child to minimal cerebral dysfunction, as well as other defects.

The chronological age of children involved in this study ranged from five years, ten months to twelve years, seven months. The mean age of the sample was eight years, three months.

Birth weights for fifty-one children of the sample of sixty were available and ranged as follows:

Weight	Number
4 to 5#	2
5 to 6#	8
6 to 7#	14
7 to 8#	14
8 to 9#	6
9 to 10#	7
Total	51

Approximately fifty percent of the children weighed less than seven pounds at birth. Only two of the fifty-one would be considered premature, weighing less than five pounds at birth. Thirteen of the cases or twenty-five percent, would be considered large babies, weighing between eight and ten pounds at birth. Approximately fifty-five percent were in the six to eight pound range. With this sample group, weight at birth did not seem a significant factor in brain-injury.

The consensus is that labor periods of the first born are of longer duration and generally more difficult. Therefore, birth ranks of children in the study were tallied with the following results:

	Number	Percent
1st born	15	25
2nd born	22	37
3rd born	11	18
4th	2	3
5th	1	2
6th	3	5
Total	54	

The majority of the children, or sixty-two percent were first or second born. Six of the sixty children of the sample group were adopted and birth rank of these was unknown.

Of adverse prenatal influences, twenty-three mothers reported positively as having conditions considered detrimental to normal pregnancy. These included serious illnesses, accidents, Rh blood factor complications, edema, etc. Thirty-one reported no known adverse condition during the gestation period. Six cases involved children who had been adopted and prenatal details were not known.

31	Negative	58%
23	Positive	42%
6	Unknown	

The majority of the mothers were unaware of any influence during the prenatal period which might be considered detrimental to the developing fetus.

Thirty-three mothers reported known birth difficulties such as unusually long labor period, precipitant birth, unusual presentations (other than cephalic), difficulty in establishing the infant's breathing, with anoxia noted in some cases. Twenty-two were unaware of any difficulties associated with delivery; these were noted as negative. Birth circumstances of five cases were unknown.

No.		Percent
22	Negative	40
33	Positive	60
5	Unknown	
60	Total	

According to the above figures, three out of five mothers were aware of adverse conditions associated with the delivery of the child.

Physical factors considered as possibly traumatic during the neonatal period included elevation of temperature over extended periods and head injuries con-

sidered severe by the parent. These were reported as follows:

Fevers			Head Trauma		
32	Negative (No high fevers)	53%	44	Negative	73%
28	Positive	47%	16	Positive	27%
60	Total		60	Total	

There were approximately as many children having experienced high fevers over an extended period as those who did not. However, when considering head trauma, one out of four reported serious head injuries.

Developmental Variables:

Developmental milestones were next appraised. There is a popular concept that the brain-injured often lags in the establishment of such skills as walking, talking toilet training. The upper limits of age ranges for these skills is thought to be: eighteen months for walking, two- and one-half years for toilet training and connected discourse by the age of three years. If the child was slow in any one of these areas, this variable was designated"late." The results were as follows:

41 cases reported developmental milestones as normal

19 cases reported developmental milestones as late

60 Total

According to the above figures, sixty-eight percent of the sample established developmental milestones at the appropriate ages; thirty-two percent were considered late in these areas.

The parent's evaluation of the child's coordination in both the gross and fine areas determined the entry under these two variables. These were described as follows:

Fine Coordination		Gross Coordination	
40 reported poor	68%	33 reported poor	55%
16 reported good	27%	25 reported good	42%
3 reported fair	5%	2 reported fair	3%
1 unreported		60 Total	
60 Total			

According to this sample, fine coordination was noted as poor more often than was gross coordination. In three out of four cases, fine coordination was recognized as less than good; whereas, gross coordination was considered faulty in fifty-eight percent of the cases.

Problems in verbal communication were noted under Language Problems. Vocabularies of the minimally brain-injured are sometimes impressive; however, it is in usage that difficulty is often noted. Grammatical con-

fusions and mild speech irregularities are also associated with these children. These disorders can be further differentiated as either expressive or receptive in nature. Impaired discrimination of auditory stimuli is often suspect. In this study, language problems were prominent in thirty-two of the children, or fifty-three percent of the sample group. Twenty-eight children or forty-seven percent were reported negative or as having no deficits in the language area.

The neurological reports submitted by the medical doctors yielded the following results:

Electroencephalographic Results:	Percentage
40 were reported as abnormal	67%
15 were reported as normal	25%
5 no report	8%
60 Total	

Children reported on medication:	Percentage
41 prescribed medication	70%
18 not on medication	30%
1 unreported	
60 Total	

Electroencephalography is considered to be in the pioneer stages; hence, there is much discussion in medical circles concerning validity of diagnosis of

normal or abnormal in specific cases. On those reporting unusually slow rhythmic discharge, sharp foci in certain areas, or fourteen-six pattern, the electroencephalograph was judged as abnormal. On the basis of this, two out of every three children in the study evidenced abnormalities.

Under medications prescribed, there was frequent mention of Dexedrine, Dilantin, Nembutal and other drugs in the stimulant, depressant and anti-convulsive categories. A significant percentage of these children, approximately three out of every four were on medication to make them more tractable within home and school situation.

Behavior Variables:

Often the only obvious manifestation of brain-injury is in the behavior problems evidenced. Alfred Strauss has enumerated these and the term Strauss Syndrome in common terminology with professionals dealing with these children. Hyperactivity, distractibility, short attention span, motor and verbal perseveration are common complaints. Eighty-eight percent of the sample evidenced such characteristics. The disruptive influence these behavior disorders would cause in a regular classroom was no doubt instrumental in referral and early diagnosis. The brain-injured child without such obvious manifestations would possibly not fare as well.

Strauss Syndrome

53 cases reported positive 88%

7 cases reported negative 12%

60 Total

Test Results:

The first thirty cases of the study involve children who were administered the Stanford-Binet Intelligence Scale, Form L-M. Intelligence quotients ranged from 73 to 136, with the mean intelligence quotient of 87. The basal ages(lowest age level where all subtests are passed) ranged from three years, six months to six years. Ceilings, or points beyond which no subtests were passed, ranged from six to nine years. The mean range between basal and ceiling was two years, eight months.

The five subtests selected from the Binet Scale as representative of measures of abilities in which the brain-injured are thought to be deficient are listed below with the number passing or failing each.

Patience-Rectangles, Year V

10 minus = 33%

20 plus = 67%

Number Concepts, Year VI

13 minus = 43%

17 plus = 57%

(continued).

Mazes, Year VI

9 minus = 30%

21 plus = 70%

Diamond, Year VII

24 minus = 80%

6 plus = 20%

Digits, Year VII

20 minus = 67%

10 plus = 33%

The most difficulty was encountered with Diamond, a measure of sensory and perceptual discrimination, motor coordination and imagery. Twenty-four of the thirty children were unable to successfully execute this design. Second in order of difficulty was Digits, involving immediate auditory and attention span. Twenty of the thirty were unsuccessful on this subtest. In interpreting the above data, one must keep in mind, however, that the two tests at the seven year level were higher in the scale and more difficult and that the mental ages and the chronological ages of these children varied considerably.

Cases thirty-one through sixty involve children who were administered the Wechsler Intelligence Scale for

Children. Verbal Scaled scores ranged from 74 to 121 with a mean Verbal Scaled score of 91. The Performance Scaled scores ranged from 67 to 121, with mean Performance score of 89. The Full Scale results ranged from 72 to 114, with a mean Full Scale score of 90. Forty percent of the cases had Verbal scaled scores which were superior to the Performance. Forty-seven percent had Performance scaled scores which were superior to the Verbal. Only five of the cases, or seventeen percent had a discrepancy of fifteen or more points between the Verbal and Performance. None of these discrepancies would seem diagnostically significant with this sample.

The scatter of successes among the various subtests proved somewhat more meaningful. Intertest variability ranged from three to thirteen scaled score units with a mean scaled score intertest variability of seven points. A variability of such magnitude would mean that scaled scores could range from average for the age (scaled score of 10) to retarded (scaled score of 3.) This sample confirms the theory that children with minimal cerebral dysfunction often display considerable variability of performance in various areas, resulting in a peak and valley type of test protocol.

The group's successes on the individual subtests of the WISC may be evaluated in another way. On Information, a measure of long-range retention, or organization and retention of previously learned material, the majority of the group, sixty percent scored below the average range. In Comprehension, sixty percent scored average or above. In Arithmetic, sixty percent scored below the average range. Similarities, or verbal concept formation, was not clearly differentiating with fifty-seven percent scoring below average, forty-three percent above average. Fifty-three percent of the children scored average or above on Vocabulary. Picture Completion, or the ability to recognize essential from nonessential details was evenly distributed. Picture Arrangement, the visual perception of relationships was not significantly discriminating; fifty-three percent of the group scored average and above. Perception of form and visual-motor integration as measured by Block Design was not discriminating; fifty-seven percent of the children scored average and above. Object Assembly, a measure of part-whole relationships was evenly distributed. Coding, considered a measure of eye-hand coordination proved difficult for the majority, with sixty-seven percent scoring below the average range.

On the basis of this study, more brain-injured children encounter difficulty with association and organization of experience, arithmetic processes and eye-hand coordination than with other measures represented in the Wechsler Scale. Successes on the other subtests were rather evenly distributed in the average, below and above average ranges.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary:

The purpose of this study was to determine the physical and mental characteristics common to those children who have been diagnosed as having minimal cerebral dysfunction, or who are more commonly referred to as minimally brain-injured. This term refers to those children who are near average, average or above average in intelligence and who evidence learning disabilities which are associated with deficiencies of function in the central nervous system. Possible causative factors of such neurological impairment are myriad, as are the various expressions of such impairment in specific learning disabilities and behavior problems. Identification of such children is primarily on the basis of these disabilities which make functioning within the regular classroom environment difficult.

Diagnosis is often complicated by the emotional overlay prominent in such cases as well as the lack of obvious physical signs of neurological involvement. The term minimally brain-injured does not include the multiple handicapped child; i.e., the child with cerebral dysfunction who is also blind, deaf and/or orthopedically handicapped. The task becomes one of detecting dis-

turbances in integrative capacity, often the only clue to organicity.

The sample group for the study was composed of sixty elementary age children from a large metropolitan school district. These children had been diagnosed as minimally brain-injured and were in, or awaiting placement in classes for children with minimal cerebral dysfunction. Approval for such placement was determined by a Placement Committee on the basis of a medical evaluation, school history and test protocol indicative of learning disabilities commonly associated with organicity.

The sample group was differentiated by the psychological instrument used in the intellectual assessment. Thirty children had been administered the Stanford-Binet Intelligence Scale, Form L-M. The mean chronological age for these children was six years, seven months. Another thirty had been administered the Wechsler Intelligence Scale for Children; the mean chronological age for these was nine years, ten months.

The variables used in the study can be grouped as follows:(1) physical factors, involving the pre-, para-, and postnatal periods,(2) developmental factors, and(3) the test data. Details concerning(1) and(2)

were secured through examination of parent interview forms and medical evaluation submitted by doctors.

The thirty Stanford-Binet protocols were appraised in terms of mental age, basal age and the level at which ceiling was established. The five subtests selected for particular scrutiny were: Patience at Year V, Number Concepts and Mazes at Year VI and Diamond and Digits at Year VII. These particular subtests were thought to be representative of measures of abilities found lacking or confused in the brain-injured child.

All scaled scores of the Wechsler Intelligence Scale for Children were included as variables, with the exception of Digit Span which was not administered in the majority of cases. The Verbal, Performance and Full Scale scores were also included as separate variables.

Conclusions:

On the basis of the findings in this study, the following conclusions seem justified:

1. The male child is either more vulnerable to minimal cerebral dysfunction, constitutionally or environmentally, or is possibly more easily identified. Of the sample group, seventy-five percent

were males and only twenty-five percent were females. This percentage seems consistent with other findings in the literature.

2. Of all physical history factors, difficulty at birth was reported most frequently, or in sixty percent of the cases. Sixty-two percent of the children were first or second born, with more (thirty-seven percent) in second born than in the first born classification (twenty-five percent).
3. In identifying characteristics, the brain-injured child was more often poor in the fine coordination area than in the gross. Language problems were associated with approximately half the group. Late developmental milestones were apparently not characteristic of these children; only one-third reported developmental milestones established beyond the normal age limits.
4. Although a significant eighty-eight percent reported Strauss Syndrome characteristics, one cannot conclude that such a percentage would hold for all brain-injured children. One can

conclude that such behavior characteristics make diagnosis easier.

5. On the basis of this study, mental characteristics such as significant differences in verbal and performance type tests were not evident in these children. Measures of perceptual-motor integration as measured by the Binet Scale Diamond and the Wechsler Coding proved to be the most difficult for the sample group. Information on the Wechsler and Digit Span on the Binet were also obvious areas of difficulty. Digit Span is a measure of auditory memory and attention span; Information is association and organization of experience but also involves long-range memory and attention span.

6. Although unusually long test scatter was not evident on the Binet Scale, Wechsler intertest variability was characteristic of these children. In this respect, the Wechsler Scale may prove more diagnostic for the brain-injured child. More comparative studies involving the two scales

seem desirable.

The range of disabilities and abilities revealed within the single grouping of minimal cerebral dysfunction impresses one with the magnitude of the educational and psychological problems involved. The stress must be a respect for the unique qualities of each child and a tailoring of educational adjustments to the specific disabilities revealed.

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