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An Appraisal of Psychologic Deficit in Children with Cerebral Palsy

Garret H. Yanagi
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a dissertation written by Garret H. Yanagi entitled "An Appraisal of Psychologic Deficit in Children with Cerebral Palsy." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Psychology.

G.R. Pascal, Major Professor

We have read this dissertation and recommend its acceptance:

Kenneth R. Newton, Carl Sipprelle, Leo Simons, W.O. Jenkins, Virgil E. Long

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

November 11, 1961

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Major Professor

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Accepted for the Council:

Dean of the Graduate School

AN APPRAISAL OF PSYCHOLOGIC DEFICIT IN CHILDREN WITH CEREBRAL PALSY

A Dissertation

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

---

by

Garret H. Yanagi

December 1961

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CHAPTER I

INTRODUCTION

The problem of cerebral palsy has been highlighted in recent years through various community projects. Most of the popular enthusiasm is in the care, training, and maintenance of those affected with this condition. There has been relatively little interest shown in behavioral research in this area. Thus far, it appears that the primary reason for a notable lack of systematic investigation in this whole field is directly related to an absence of a well defined formulation of the problem. Recently Pascal (1959) devised an approach which now makes possible such a formulation with regard to cerebral palsied children. This is his concept of Psychologic Deficit as measured in terms of deviation from expectancy. That is, there is greater Psychologic Deficit as the behavior being measured deviates further from the expected level for the status of an individual in a given subculture.

In the present study, it may be hypothesized that, if the extent and location of neurological involvement are known, then the subject's deficit in test performance may be directly traceable to brain damage. If there is any discrepancy in this performance-brain damage

relationship such that the deficit in performance is unaccountable in terms of a thorough neurological examination, then it would be only reasonable to look elsewhere for the cause of this deficit. Any Psychologic Deficit over and above that due to brain damage may be accounted for in terms of the child's social milieu. In this study the child's relationship with his parents, and particularly, their behavior toward him was selected for investigation since Pascal and Jenkins (1961) found this to be a significant variable in the first ten years of life for other forms of deviant behavior. It is especially meaningful as applied to the cerebral palsied child since he is unusually dependent upon his parents to look after his proper motor functioning.

According to Pascal's (1959) formula then, which has been defined by him elsewhere, deficit in performance here may be a function of either brain damage or the behavior of parents, or both. The areas of investigation that are considered in this assessment of Psychologic Deficit were: (1) gross motor behavior, (2) fine motor behavior, (3) type of involvement, (4) speech, (5) reading, (6) writing, (7) behavior in response to visual stimuli (visual performance), (8) extraocular involvement, (9) behavior in response to auditory stimuli (auditory performance), (10) current intellectual

functioning, (11) potential intelligence, (12) Hunter-Pascal Concept Formation Test performance, (13) Bender Visual Motor Gestalt test performance, (14) Draw-A-Person test performance, (15) social development, and (16) degree of motor involvement, as dependent variables to be compared with (1) neurological examination for extent and location of brain damage and (2) ratings on the Pascal-Jenkins Behavioral Scales for an assessment of parental behavior as independent variables.

It is the purpose of this study to investigate the relationship between Psychologic Deficit and the effects of brain damage and environmental experiences. It is an exploratory study, therefore concerned with descriptive, testable data which may yield hypotheses concerning cerebral palsied children.

Review of the Literature

There is a short review of the literature in this area by Meyerson in a recent issue of Annual Review of Psychology (1957) in which he recognized the difficulty in investigating this multiply handicapped group. He indicated that none of the articles dealing with emotional adjustment had reached acceptable levels of scientific reporting. Holden (1952), in another review article, indicated that the majority of the studies in this area

were descriptive of age, incident, etiology, and intellectual deficit. In the most recent review of research on cerebral palsy by Haring (1959), personality has entered the realm of investigation. There have been attempts to find a relationship between perceptual-motor impairment and emotional disturbance. These attempts include the poor motivation found among cerebral palsied children by different investigators (Garmezy & Harris, 1953; Sheer, 1954; Wenar, 1953). Sheer (1954) equates motivation, attention, arousal, and emotional mobilization on grounds that these states of the organism have in common the same underlying physiological process. The importance of parental attitudes toward crippled children has also been recognized, giving rise to several studies in this area (Bice, 1954; Denhoff & Holden, 1954; Shere, 1956; Stoddard, 1959).

The impact of parental overindulgence, overprotection, or overconcern on the emotional stunting of the cerebral palsied seems to be another common problem. Due to the crippled child's dependent relationship with some older person, parental attitudes undoubtedly play a big role in influencing the child's adjustment toward his own condition. Conversely, the severity of the child's motor involvement may influence the parents' behavior toward him. Kammerer (1940) found that children in

families who were indulgent were less well adjusted, as compared with children in families who revealed no signs of overprotection.

In the present study a more parsimonious view was taken in that parental "attitude", a vague, elusive term, was avoided, and parental behavior, given systematic definition, was subjected to investigation. In gathering the data, specific incidents in the parent-child relationship were obtained defining the behavior under investigation.

Other studies have been undertaken to demonstrate a relationship between the extent of neuromuscular handicap and the severity of mental defect. According to Cardwell (1956), studies in this area have not shown sufficient evidence as yet to support such a relationship. In her book on cerebral palsy, Cardwell (1956) cites Dunsdon's study in which quadriplegics were more likely to be severely mentally defective than hemiplegics or paraplegics. She also cites Asher and Schonell's study in which quadriplegics showed the poorest average in mental tests and the paraplegics were next lowest.

Block (1954) indicates a need for further research to determine whether the degree of the handicap is a primary or secondary factor concerning the degree of maladjustment. This statement refers to opposing points of view

regarding the effects of crippling. The first is represented by Barker, Wright, & Gonick (1950), who conclude in a review that the nature of the disability is relatively unimportant, within wide limits, so far as behavioral resultants are concerned. One of the studies in agreement with this view is that of Cruickshank and Dolphin (1949a, 1949b) in which they compared crippled children with their matched controls on a test of emotional needs and found no significant differences between groups. Cruickshank and Bice (1955), in arguing against group characteristics, maintain that emotions are the product of specific learning situations.

The opposing view is that of Phelps (1941) who states that impaired function itself produces different environmental experiences and hence affects the motor habits and psychological behavior. Partially to support this latter view Block's study (1956) indicates that among his spastic group there was a trend toward increasing maladjustment with increasing physical disability. Donofrio (1951) also found that a degree of maladjustment appeared related to degree of disability.

Somewhat related to the foregoing discussion is Phelps' (1948) original observation that certain personality traits are more common in some types of cerebral palsy than in others. For example, the athetoid child is

supposedly almost universally free of excessive fear whereas the spastic child has many fears of all kinds. Also, the athetoid has been observed to express the emotions of affection, anger, and rage much more readily than the spastic. Such observations, however, have not been supported by experimental evidence. Haring (1959) has already pointed out in his review that the results may show more heterogeneity of personality characteristics within any one group than between groups. The type of cerebral palsy, he states, in and of itself, seems to have less influence upon the emotional adjustment of the cerebral palsied child than the experiences they have with themselves in relation to their parents, siblings, peers, and other persons in their life.

Thus, an attempt has been made to point out various viewpoints and corresponding contradictory experimental evidence with regard to the cerebral palsied. One criticism which is inherent in many of these studies lies in the difficulty encountered in replicating them. This difficulty was seen in the lack of definition of terms, as well as of well defined groups, and in the absence of basic, behavioral data, all of which this study sought to provide in order to make replication possible.

CHAPTER II

METHODOLOGY

The methodology employed in this study includes the formulation developed by Pascal (1959) as well as the Behavioral Scales devised by Pascal and Jenkins (1961). Pascal's formulation served as a model throughout the investigation in that his concept of Psychologic Deficit (P.D.) as used in the case of the cerebral palsied child was seen as a function of brain damage or parental behavior or both:

P.D. (cerebral palsied behavior) = f (brain damage + parental behavior)

Dependent Variables

Various kinds of behaviors were selected for investigation in this study in order that a fairly comprehensive appraisal of the child's functioning could be obtained. They were in the following areas:

A. Gross motor behavior - sitting, standing, walking.

B. Fine motor behavior - touching ends of fingers, thumb apposition, tremors.

C. Type of involvement - spasticity, athetosis, ataxia.

D. Speech - dysarthria (brain damage), articulation, rhythmic delivery, defects of pitch, intensity, quality and volume.

E. Reading - Wide Range Achievement Test, Gray Oral Reading Test.

F. Writing - Wide Range Achievement Test (Spelling).

G. Visual - acuity, form discrimination, color discrimination, comprehension, memory.

H. Extraocular involvement - eye movement, strabismus, nystagmus.

I. Auditory, acuity, discrimination, comprehension, memory.

J. Current intellectual functioning - Ammons Full-Range Picture Vocabulary Test, Cattell Infant Intelligence Scale, Gesell Developmental Schedule, Stanford-Binet Intelligence Scale, Wechsler Intelligence Scale for Children.

K. Potential intelligence - Ammons Full-Range Picture Vocabulary Test, Cattell Infant Intelligence Scale, Gesell Developmental Schedules, Stanford-Binet Intelligence Scale,

Wechsler Intelligence Scale for Children.

L. Hunter-Pascal Concept Formation Test performance.

M. Bender Visual Motor Gestalt test performance.

N. Draw-A-Person test performance.

O. Social development - Vineland Social Maturity Scale.

P. Degree of motor involvement - as judged by an orthopedic surgeon.

For each of the above variables, expectancy levels for age and performance were defined (norms being available in most cases) in order that each variable may be rated as to the amount of deficit in the child's performance.

Following the Pascal and Jenkins method, the rating of "one" was given to extreme deviation from expectancy or severe deficit in performance; the rating of "two" was given to deviation from expectancy between the ratings of one and three, or mild to moderate deficit in performance; the rating of "three" was given to performance at expectancy or that which showed little or no deficit. The expectancy ratings were defined as follows:

A. Gross Motor Behavior (Ratings by physical therapist).

a. Sitting (all age levels).

1. Unable to sit without support.
2. Able to sit without support but with observable impairment in posture.
3. Able to sit without support and with no observable impairment in posture.

b. Standing (all age levels).

1. Unable to stand without support.
2. Able to stand without support but with observable impairment in stance.
3. Able to stand without support and with no observable impairment in stance.

c. Walking (all age levels).

1. Unable to walk without support.
2. Able to walk without support but with observable impairment in gait.
3. Able to walk without support and with no observable impairment in gait.

B. Fine Motor Performance.

a. Touching ends of fingers (all age levels).

1. Unable to make tips of index fingers of both hands meet from arms extended position with eyes closed.
2. Able to make finger tips meet only with difficulty, that is, not immediately upon command, and with eyes closed.

3. Able to make finger tips meet without any difficulty, that is, immediately upon command, and with eyes closed.

b. Thumb-finger apposition (all age levels).

1. Complete lack of thumb-finger apposition.
2. Thumb-finger apposition with any amount of difficulty or delay upon command.
3. Thumb-finger apposition with no difficulty, that is, immediately upon command.

c. Hand tremors (Ratings by physical therapist for all age levels).

1. Gross tremors which incapacitate voluntary activity.
2. Mild to moderate tremors which interfere with but do not incapacitate voluntary activity.
3. Absence of observable tremors in performing any activity.

C. Type of Involvement (Ratings by physical therapist).

a. Spasticity (all age levels).

1. Severe, incapacitating spasticity which interferes with motor behavior.

2. Mild to moderate spasticity which interferes with but does not incapacitate motor behavior.
3. Absence of any observable spasticity.

b. Athetosis (all age levels).
1. Severe, incapacitating athetosis which interferes with motor behavior.
2. Mild to moderate athetosis which interferes with but does not incapacitate motor behavior.
3. Absence of any observable athetosis.

c. Ataxia (all age levels).
1. Severe, incapacitating ataxia which interferes with motor behavior.
2. Mild to moderate ataxia which interferes with but does not incapacitate motor behavior.
3. Absence of any observable ataxia.

D. Speech (Ratings by speech therapist).

a. Articulation (all age levels).
1. Severe defect including baby talk, lisping, substitutions, and other forms of inaccurate speech.
2. Mild to moderate articulation defect.
3. No articulation defect.

b. Rhythmic delivery (all age levels).

1. Severe disorders of rhythmic delivery including stuttering, stammering or cluttering through speedy or sloppy delivery.
2. Mild to moderate disorders of rhythmic delivery.
3. No disorders of rhythmic delivery.

c. Defects of pitch, intensity, quality and volume (all age levels).

1. Severe defects of pitch, intensity, quality and volume.
2. Mild to moderate defects of pitch, intensity, quality and volume.
3. No defects of pitch, intensity, quality and volume.

d. Dysarthria (all age levels).

1. Severe dysarthria according to the test for dysarthria in Wells and Ruesch's Handbook (1945).
2. Mild to moderate dysarthria.
3. No dysarthria.

E. Reading.

1. Inability to read or severe reading difficulty which corresponds to an IQ below 70

as shown by reading tests.

2. Mild to moderate difficulty which corresponds to an IQ between 70 and 90 as shown by reading tests.
3. No reading difficulty, i.e., corresponding to an IQ of 90 and above as shown by reading tests.

F. Writing.

1. Inability to write legibly for age level.
2. Distortions present but legible.
3. No distortions and legible.

G. Visual Performance.

a. Acuity (all age levels).

1. Severe deficit as tested by the illiterate E Chart: 20/80 and over for both eyes.
2. Mild to moderate deficit as tested by the E chart: between 20/20 and 20/80 for both eyes.
3. No deficit as tested by the E chart: 20/20 vision for both eyes.

b. Form discrimination.

1. The highest form discrimination task passed on a standard intelligence test corresponding to a Mental Age giving

an IQ below 70. Also, inability to differentiate similar geometric designs, i.e., a series in which a square approximating a circle in four steps is seen as alike.

2. The highest form discrimination task passed on a standard intelligence test corresponding to a Mental Age giving an IQ between 70 and 90. Also, some difficulty in discriminating similar geometric designs, i.e., a series in which a triangle with curved sides approximating a circle in four steps is seen as alike.

3. The highest form discrimination task passed on a standard intelligence test corresponding to a Mental Age giving an IQ of 90 and above. Also, no difficulty in discriminating similar geometric designs described above.

c. Color discrimination (all age levels).

1. Complete failure in naming colors as presented by Wells and Ruesch (1945), given unlimited time.

2. Between one and six errors, or exceeding one minute, in naming the colors.
3. No errors in naming all the colors within one minute period.

d. Comprehension.

1. The highest visual comprehension task passed on a standard intelligence test corresponding to a Mental Age which gives an IQ below 70.
2. The highest visual comprehension task passed on a standard intelligence test corresponding to a Mental Age which gives an IQ between 70 and 90.
3. The highest visual comprehension task passed on a standard intelligence test corresponding to a Mental Age which gives an IQ of 90 and above.

e. Memory.

1. The highest visual memory task passed on a standard intelligence test corresponding to a Mental Age which gives an IQ below 70.
2. The highest visual memory task passed on a standard intelligence

test corresponding to a Mental Age which gives an IQ between 70 and 90.

3. The highest visual memory task passed on a standard intelligence test corresponding to a Mental Age which gives an IQ of 90 and above.

H. Extraocular Movement (Evaluations by a neurologist).

a. Eye Movement (all age levels).

1. Complete failure in following moving object with eyes.

2. Following moving object with any degree of difficulty, that is, jerky inconsistent movements.

3. Following moving object without any difficulty, that is, smooth movement in any one direction.

b. Strabismus (all age levels).

1. Severe, incapacitating strabismus which interfered with vision in one or both eyes.

2. Mild to moderate but not incapacitating strabismus which interfered with vision in one or both eyes.

3. Absence of strabismus.

c. Nystagmus (all age levels).

1. Severe, incapacitating nystagmus which interfered with vision in one or both eyes.
2. Mild to moderate but not incapacitating nystagmus which interfered with vision in one or both eyes.
3. Absence of nystagmus.

I. Auditory Performance.

a. Acuity (Ratings by speech therapist for all age levels).

1. Severe deficit binaurally as measured by pure tone air conduction audiometry: greater than 55 db. loss within the frequency range of 125 cps. to 8000 cps. (Van Riper, 1954).
2. Mild to moderate deficit binaurally as measured by pure tone air conduction audiometry: between 15 db. to 55 db. loss within the frequency range of 125 cps. to 8000 cps.
3. No deficit binaurally as measured by pure tone air conduction audiometry: 0 db. to 15 db. loss within the frequency range of 125 cps. to 8000 cps.

b. Discrimination (Ratings by speech therapist for all age levels).

1. Severe deficit monaurally (more defective ear as measured by acuity test) as measured by pure tone air conduction audiometry, i.e., inability to differentiate between 1000, 2000, 3000 and 4000 cps. above 55 db. Also, speech discrimination score using Harvard PBK word lists (Hirsch, 1952) found to be below 50% binaurally.

2. Mild to moderate deficit monaurally as measured by pure tone air conduction audiometry, i.e., inability to differentiate between 1000, 2000, 3000 and 4000 cps. at 15 db. to 55 db. Also, speech discrimination score using Harvard PBK word lists found to be between 50% and 98% binaurally.

3. No deficit in either ear as measured by pure tone air conduction audiometry, i.e., ability to differentiate between 1000, 2000, 3000 and 4000 cps.

at 0 db. to 15 db. Also, speech discrimination score using Harvard PBK word lists found to be 98% to 100% binaurally.

c. Comprehension.

1. The highest auditory comprehension task passed on a standard intelligence test which corresponds to a Mental Age giving an IQ below 70.
2. The highest auditory comprehension task passed on a standard intelligence test which corresponds to a Mental Age giving an IQ between 70 and 90.
3. The highest auditory comprehension task passed on a standard intelligence test which corresponds to a Mental Age giving an IQ of 90 and above.

d. Memory.

1. The highest auditory memory task passed on a standard intelligence test corresponding to a Mental Age which gives an IQ below 70.
2. The highest auditory memory task passed on a standard intelligence test corresponding to a Mental Age which

gives an IQ between 70 and 90.

3. The highest auditory memory task passed on a standard intelligence test corresponding to a Mental Age which gives an IQ of 90 and above.

J. Current Intellectual Functioning.

1. Below IQ 70 as measured by any one or more of standard intelligence tests including Ammons Full-Range Picture Vocabulary Test, Cattell Infant Intelligence Scale, Gesell Developmental Schedule, Stanford-Binet Intelligence Scale, Wechsler Intelligence Scale for Children.
2. Between IQ 70 and 90 as measured by any one or more of standard intelligence tests listed above.
3. At IQ 90 or above as measured by any one or more of standard intelligence tests listed above.

K. Potential Intelligence.

1. Below IQ 70 as estimated by any one or more of standard intelligence tests listed above.
2. Between IQ 70 and 90 as estimated by any

one or more of standard intelligence tests listed above.

3. At IQ 90 or above as estimated by any one or more of standard intelligence tests listed above.

L. Hunter-Pascal Concept Formation Test.

1. Severe deficit, which, according to Pascal and Jenkins' norms (1959) gives a Mental Age corresponding to IQ below 70.
2. Mild to moderate deficit, which, according to Pascal and Jenkins' norms gives a Mental Age corresponding to IQ between 70 and 90.
3. No deficit, which, according to Pascal and Jenkins' norms, gives a Mental Age corresponding to IQ 90 and above.

M. Bender Visual Motor Gestalt Test Performance.

1. Performance according to Bender's norms (1938) corresponding to Mental Age giving IQ below 70.
2. Performance according to Bender's norms corresponding to Mental Age giving IQ between 70 and 90.
3. Performance according to Bender's norms corresponding to Mental Age giving IQ 90

and above.

N. Draw-A-Person Performance.

1. Performance according to Goodenough's norms (1926) corresponding to Mental Age giving IQ below 70.
2. Performance according to Goodenough's norms corresponding to Mental Age giving IQ between 70 and 90.
3. Performance according to Goodenough's norms corresponding to Mental Age giving IQ 90 and above.

O. Social Development.

1. Below S.Q. 70 on the Vineland Social Maturity Scale.
2. Between S.Q. 70 and 90 on the Vineland Social Maturity Scale.
3. At S.Q. 90 and above on the Vineland Social Maturity Scale.

P. Motor Involvement (Evaluations by orthopedic surgeon).

1. Severe, incapacitating motor involvement for a particular type and location of cerebral palsy.
2. Moderate motor involvement for a particular type and location.

3. Mild motor involvement for a particular type and location.

Independent Variables

Two areas of study were selected to serve as independent variables. One was within the organism itself, that is, the extent and location of brain damage. This was obtained through a thorough neurological evaluation in which the neurologist was asked to describe each child as to the extent and severity of involvement. The evaluations were then rated by the experimenter on a 1(severe deficit) - 2(moderate deficit) - 3(mild or no deficit) basis.

The second independent variable to be considered was that of the parental behavior toward the child, and the technique deemed best suited to investigate this relationship lay in the utilization of the Pascal-Jenkins (P-J) Behavioral Scales. Through the use of one aspect of these comprehensive Scales in the individual interview situation, relevant cross-sectional data were obtained with every available parent serving as the stimulus in the parent-child relationship. The means by which the data were collected for the P-J Scales was the "Behavioral Incident" technique. According to Pascal and Jenkins (1961), a "Behavioral Incident" is a "stimulus-response

sequence in gross human behavior which endures so long as there is no radical change in the stimulus situation as defined by the responses of the subject to it". The following stimulus-response sequence in a portion of the mother's behavior labeled Providing Behavior may serve as an example:

E: What do you do of your own accord for your son's condition?

S: You mean like to help him walk?

E: Yes.

S: Well, I massage his leg muscles, put him on a table and work his legs up and down, I stretch his tightened muscles, and try to get him to walk on his crutches instead of being carried everywhere. I also see that his night braces are on at bedtime even if they might hurt a bit. He has to learn to rely on himself more now that he's getting big and heavy.

E: Does he ever ask you to do any of these things for him?

S: Yes, he might ask me to go for a walk with him while he uses his crutches.

E: How often?

S: Oh, about once a day if the weather's good.

E: What do you do then?

S: Well, I may or may not go depending on what I'm doing at the time. If I'm doing something important or urgent like housecleaning, cooking, or washing dishes, I can't stop everything just for his sake.

E: What do you tell him?

S: I tell him to wait until I get done with whatever I'm doing and then I'll go with him.

E: And do you?

S: Yes, almost always, unless something else comes up.

E: And how often does that happen?

S: Oh, not often, in fact rarely . . . about once a month.

E: And if whatever you're doing is not urgent?

S: Say, if I'm reading a magazine or writing a letter that I can get back to later I'll drop it and go with him.

Further data concerning the frequency, duration, intensity, latency, and conditions for each of the things she did for him were also obtained so that a rater trained in this procedure could read it and rate the mother on one aspect of providing behavior which may be called satisfaction of motor needs in a cerebral palsied child. The rating again was on a 1-2-3 basis according to how closely

the parent's behavior approached expectancy.

Materials

The Pascal-Jenkins Behavioral Scales

The Pascal-Jenkins Behavioral Scales (Pascal & Jenkins, 1961) are an attempt at "systematic observation of gross human behavior" as the title of their book indicates. As such the Scales fit in well with the purpose of investigating parental behavior toward the child. It is accomplished by the Behavioral Incident technique in the face-to-face interview situation.

For the purposes of the study only that part of the Scales was used which dealt with parents as stimuli. The Scales included seventeen areas of investigation in the parents' behavior as follows: (1) frequency of contact, (2) play activities, (3) displays of affection, (4) providing behavior, (5) restraints, (6) physical punishment, (7) verbal punishment, (8) intellectual behavior, (9) status, (10) social behavior, (11) religious behavior, (12) physical health, (13) compatible behavior, (14) role behavior, (15) variability of habitat, (16) sexual behavior, (17) deviant behavior.

The Behavioral Incident technique required the use of the following basic measures of observation which were applied in this case in order to obtain cross-sectional

data which could be rated with a high level of reliability and validity: (1) frequency, (2) latency, (3) rate, (4) intensity, (5) duration, (6) amount, (7) variety, (8) conditions, (9) direction, (10) correctness. Not all of these measures were applicable to each of the seventeen variables but they were employed wherever the data called for them. Their definitions are spelled out by Pascal and Jenkins (1961) in their book.

The Hunter-Pascal Concept Formation Test

The Hunter-Pascal (H-P) Concept Formation Test (Pascal and Jenkins, 1959) is an instrument which is used in the attempt to measure some aspect of human capacity not previously tested systematically. It consists of two fundamental problems, delayed reaction and alternation, which are purportedly related to phylogenetic evolvement and to maturation in humans. Pascal and Jenkins (1959) hypothesize that performance on the test is related to freedom from distractibility, learning, retention, and flexibility. Since a description of the test has already been published, no attempt will be made to describe it here. Considering the demonstrated relationship between the two basic problems and cortical capacity, it was deemed a good test to use with cerebral palsied children.

Other Materials

Other materials and apparatus used in this study included the Cattell Infant Intelligence Scale, the Stanford-Binet Intelligence Scale Form L-M, the Wechsler Intelligence Scale for Children, the Wide Range Achievement Test, the Ammons Full-Range Picture Vocabulary Test, the Gesell Developmental Schedules, the Vineland Social Maturity Scale, the Bender Motor Gestalt Test, the illiterate E chart, and the Beltone 14-A Audiometer.

Subjects

Fifteen children, diagnosed as cerebral palsy, served as subjects for this study. Only those falling within the age range of six to fifteen were selected in order to make these groups somewhat comparable to those used in studies which investigated parental behavior in the first ten years of life. The selection of the subjects depended primarily upon the availability of the parents or the accessibility of the child to the performance tasks.

All of the subjects attended the Knoxville Cerebral Palsy Center which serves three counties and which had a total attendance of sixty-eight at the time of this study. Of this total attendance, thirty-seven (55 per cent) were within the age range selected for this study, and of these

fifteen (22 per cent of the total number) served as subjects. The selective factors involved undoubtedly contributed to more homogeneity than would otherwise have been the case.

Table I shows some characteristics of the subjects in this study. There were eight females and seven males. Their ages ranged from six to fourteen and the median age was nine. There were two Negro subjects (Nos. 6 and 15). Two subjects (Nos. 2 and 14) were not attending school at all, while the others were either in Special Education (educable and severely mentally retarded) or in regular classes.

The types and locations of cerebral palsy (with the number of subjects in parentheses) were diagnosed by an orthopedic surgeon as follows: spastic hemiplegia(2), spastic paraplegia(3), spastic quadriplegia(1), athetoid quadriplegia(3), mixed quadriplegia(1), ataxia(4), and an additional group diagnosed as "cerebral palsy type unknown"(1) due to the lack of a clear-cut motor involvement. In terms of the degree of motor involvement, five were diagnosed as severe, four as moderate, and six as mild. According to available medical records, all of their conditions were traceable to pre- and post-natal conditions and the causes were given variously as complications of pregnancy or of the birth process such as ill

TABLE I

SOME CHARACTERISTICS OF THE SUBJECTS

Subj. No.	Sex	Age	Sch. Grade	Diagnosis		S-B IQ	H-P Score
1	F	9	EMR	Spast. quad.	sev.	82	260
2	M	7	-	Mixed quad.	sev.	66	251
3	F	10	EMR	Ataxic	mod.	58	266
4	M	14	EMR	Spast. para.	mod.	89	206
5	F	8	EMR	Ataxic	sev.	50	266
6	F	11	5	Spast. l.h.	mild	76	250
7	M	10	EMR	Ath. quad.	sev.	86	177
8	F	13	SMR	Ath. quad.	mild	38	250
9	M	10	EMR	Ataxic	mild	56	254
10	F	9	3	Spast. r.h.	mod.	81	242
11	F	8	SMR	Ath. quad.	mod.	33	271
12	M	8	SMR	C.P. unknown		51	251
13	F	10	3	Spast. para.	mild	72	242
14	M	6	-	Spast. para.	sev.	71	261
15	M	8	3	Ataxic	mild	125	177

health, premature or late delivery, prolonged and difficult or precipitate labor, forceps delivery, Rh factor, and convulsions. Their IQ's (current functioning) as derived from their performance on the Stanford-Binet Intelligence Scale ranged from 33 to 125 with the median at 71. The scores on the Hunter-Pascal Concept Formation Test ranged from 177 to 271 with the median at 251.

Five of the subjects (Nos. 4, 6, 13, 14, 15) had no father or father substitute for the purposes of the P-J ratings. For these subjects, one (No. 4) father was deceased while the remaining fathers were divorced and totally absent. One subject (No. 15) lived with his paternal grandmother. Of the remaining subjects, only one (No. 5) lived with parental substitutes, an aunt and uncle. The occupations of the fathers included a chemical technician, a grocer, a sanitarian, three salesmen, and four laborers. Of the mothers, five of the total worked but two of them were part-time helpers at the Cerebral Palsy Center. The remaining three who worked included a teacher, a social worker, and a mill worker. All five mothers who were divorced or widowed did not work steadily and served as housewives most of the time.

Procedure

All of the subjects were given a thorough

intellectual evaluation by graduate students in the diagnostic testing class at the University of Tennessee.[1] On the basis of their performances on the various tests, the subjects were rated by the experimenter on the following variables: current IQ, potential IQ, Social Quotient, Hunter-Pascal test performance, Bender Motor Gestalt performance, Draw-A-Person performance, form and color discrimination, visual comprehension and memory, auditory comprehension and memory, reading, and writing.

The experimenter obtained other data which were not included in the standard intelligence tests. These were: touching tips of the index fingers with eyes closed, finger-thumb apposition, visual acuity, form discrimination, and pure tone discrimination.

A physical therapist who worked with the subjects and knew them well rated them on gross motor behavior (sitting, standing, walking), type of involvement (spasticity, athetosis, ataxia), and tremors. A speech therapist who also worked with the subjects rated them on dysarthria, articulation, rhythmic delivery, and defects of pitch, intensity, quality, and volume, and tested their auditory acuity for pure tones with the audiometer. This

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[1]The author is grateful to the following students for their part in the intellectual evaluation: C. Boutwell, M. Deleanu, J. Drumheller, W. Henderson, E. Land, P. Shockley.

covered the dependent variables.

In the treatment of one of the independent variables, a neurologist examined the subjects thoroughly and, on the basis of his report, the experimenter rated the neurological involvement as to (1) severe damage, (2) mild to moderate damage, and (3) no damage.

In the treatment of the other independent variable, the subjects' parents were interviewed separately by the experimenter for cross-sectional data using the Pascal-Jenkins Scale. Each parent, who served as a stimulus for the subject, was told that a thorough study of his child was being made and that his full cooperation was needed in order to make it a success. The importance of such a study was stressed, especially in the future treatment and training of the child, and all questions were answered so that they would fully understand the purpose of this investigation.

When a parent was unable to come to the Cerebral Palsy Center for the interview, the experimenter went to the home in order to collect the data. Although some parents responded to the interview tangentially or in vague, irrelevant terms, or in relatively non-verbal terms that made it difficult to gather Behavioral Incidents, almost all who were approached assented to the interview. The interviews were recorded verbatim on prepared outline

sheets which allowed one page per variable. The time required for each interview varied from two to five hours, depending on the relevancy of the parent's verbal responses, on his willingness to give Behavioral Incidents, and on his ability to respond rapidly to interview questions.

Every parent was rated on the seventeen variables by two graduate students who had previous training in the interview technique involved in the P-J Scales. Each variable was rated on a three-point basis according to the degree to which parental behavior fulfilled expectancy. When there was insufficient data for rating purposes, a "no data" (ND) category was used. A "zero" rating was used when stimulus was absent, as in the case of a deceased father. The judges arrived at their ratings independently and without any knowledge of the subjects or their parents.

Reliability and Validity

Reliability of Judges' Ratings

The reliability of the ratings by the two independent judges on the seventeen variables of the Pascal-Jenkins Behavioral Scales can be seen in Table II. It presents the per cent agreement between the two judges on the mother and father as stimuli for all subjects. The

TABLE II

RELIABILITY OF RATINGS BY TWO INDEPENDENT JUDGES ON SEVENTEEN VARIABLES OF THE PASCAL-JENKINS BEHAVIORAL SCALES

Subject	Per cent complete agreement		Per cent disagreement by one point	
	Mother	Father	Mother	Father
1	77	77	23	23
2	71	77	29	23
3	88	94	12	6
4	71	--	29	--
5	81	63	19	37
6	75	--	25	--
7	88	63	12	37
8	88	71	12	29
9	71	77	29	23
10	100	100	0	0
11	77	71	23	29
12	77	82	23	18
13	82	--	18	--
14	88	--	12	--
15	71	--	29	--
Total	80	78	20	22

"no data" (ND) category and the "stimulus absent" or "zero" category were not used. The latter category applied to fathers of subjects 4, 6, 13, 14 and 15. The judges had complete agreement in 80 per cent of their ratings on the mother and 78 per cent of their ratings on the father. They disagreed by one point in 20 per cent of their ratings on the mother and 22 per cent of their ratings on the father. In no case did they disagree by as much as two points. These results are essentially in agreement with the reliability figures of previous studies (Pascal & Jenkins, 1960; Pascal & Jenkins, 1961; Horner, 1961) employing the P-J Scales.

Validity of the Data

In this study it was possible to check the validity of the data obtained in the interview through observation of the parent-child relationship, the parents' behavior, and the child's behavior or appearance whenever they presented themselves at the Cerebral Palsy Center or when the experimenter visited their homes unexpectedly on several occasions. In most cases the nature of the Behavioral Incident technique insured such thoroughness in the gathering of the data that there was little deviation of the data from actual behavior.

It was not possible to validate the neurological

judgments involved in this study since there is no available technique whereby brain damage may be directly observed.

The validity of the speech therapist's rating for each subject was checked by comparing her initial judgments of mild, moderate or severe speech impairment with her later, more objective rating on the four variables (dysarthria, articulation, rhythm, and defects of pitch, intensity, quality, volume). The initial judgment was made according to an overall impression which the therapist obtained through observation, whereas the later ratings were made according to the definitions of deficit which were furnished by the experimenter. The comparison of initial and later ratings showed very high agreement, indicated by the chi square value of 13.2, which gave a significance beyond the one per cent level.

CHAPTER III

RESULTS

Introduction

The 3x3 chi square technique was employed as the most appropriate statistical device for the design of this study. Although the requirements for the use of this technique were not completely fulfilled due to the small number of subjects, the technique yielded adequate information and promoted understanding of the data. All ratings which comprised the raw data are presented in the Appendices.

Independent versus Dependent Variables

In analyzing the data, twenty-two dependent variables were compared with eight criterion variables. Two dependent variables, behavior in response to visual and to auditory stimuli, were further divided into sub-categories in order that a more meaningful analysis may be made. The two basic criterion variables which were derived from the neurological and the P-J Scale data were divided into narrower areas of study for the sake of more detailed investigation of the relationships. Hence, the

neurological variable was further split into a sensory-motor variable which was finally separated into a sensory and a motor variable. The P-J Scale data, which first combined the father and mother as one variable, were divided into father only and mother only variables. Finally, both neurological and P-J Scale data were combined and their results were subjected to additional analyses.

Each subject was given a final rating of mild, moderate or severe on every variable. In cases where the average numerical ratings were spread over a narrow range, the two extreme ratings were given final ratings of mild and severe, and all other ratings which fell along a continium in between were called moderate. Hence, although the average numerical ratings for the neurological and the P-J Scale data ranged between 2 and 3, they were split into three groups for the basis of comparison. In combining the neurological and P-J Scale data, the lower (more deficit) rating of the two variables was used as the final rating to serve as the criterion variable.

Table III presents the chi square values of the neurological and the P-J Scale data as compared with various kinds of motor performance and behavior in response to sensory stimuli. Tables IV and V indicate the variables which emerged as significantly related to the criterion

TABLE III

CHI SQUARE VALUES OF NEUROLOGICAL AND PASCAL-JENKINS SCALE DATA AS COMPARED WITH VARIOUS KINDS OF SENSORY-MOTOR PERFORMANCE

	Neuro-logical	Sen.-Motor	Sen. Area	Motor Area	P-J (F+M)	P-J (F)	P-J (M)	P-J(F+M + Neuro.)
Motor Involve.	9.5***	4.6	3.3	11.5***	1.8	4.5	2.7	7.3*
Current IQ	4.1	6.1*	13.9***	4.7	6.1*	9.9***	4.9	9.8***
Hunter-Pascal	5.3	10.0***	11.9****	4.2	4.8	2.5	6.9*	3.8
Draw-A-Person	3.5	1.9	3.4	1.7	4.8	7.2*	4.0	6.8*
Bender-Gestalt	4.3	6.8*	3.5	.8	3.8	4.4	3.8	2.8
Social Func.	8.2**	1.4	4.0	2.4	7.7**	6.2*	7.2*	3.9
Poten. Intell.	6.2*	11.4***	7.2*	8.9**	4.3	2.6	6.6*	5.2
Gross Motor	6.4*	4.3	3.3	11.0***	3.8	2.5	3.4	4.7
Fine Motor	5.7	4.8	11.3***	1.7	10.6***	4.9	10.8***	2.9
Type Involve.	6.0*	11.0***	10.6***	10.3***	1.8	1.1	2.7	4.6
Visual	6.7*	4.7	2.7	3.9	7.9**	3.6	7.8**	4.2
Extraocular	12.0****	10.6***	12.8***	5.4	1.3	2.6	2.4	11.3***
Auditory	4.6	11.9****	7.3*	10.6***	4.5	4.6	5.5	3.7
Speech	6.7*	3.0	5.9	4.5	4.2	10.2***	4.4	4.6
Reading	1.7	8.4**	.9	9.2**	7.3*	6.1*	6.5*	8.3**
Writing	6.2*	4.6	3.7	1.1	15.9****	9.9***	13.4****	5.3
Visual Discrim.	3.5	3.6	6.3*	2.3	4.9	4.4	5.0	5.0
Visual Comp.	2.6	9.9***	2.8	2.8	5.6	2.3	6.8*	6.3*
Visual Memory	5.3	16.7****	7.1*	3.1	4.7	2.1	6.7*	4.1
Auditory Disc.	3.0	2.5	2.4	4.2	1.3	3.8	2.6	3.7
Auditory Comp.	7.6*	11.8****	6.8*	4.2	10.5***	6.0*	7.5*	7.8**
Auditory Memory	5.5	9.4**	10.7***	6.1*	7.9**	7.8**	4.9	2.3

*p between .05 and .10
**significant at the .05 level
***significant at the .025 level
****significant at the .01 level

TABLE IV

RELATIONSHIPS BETWEEN VARIABLES WHICH EMERGED AS SIGNIFICANT, NEAR SIGNIFICANT, OR NON SIGNIFICANT WHEN COMPARED WITH NEUROLOGICAL VARIABLES

	Neurological	Sensory-Motor	Sensory	Motor
Significant relationship	Motor involve. Social func. Extraocular movement	H-P test perform. Potential intell. Type involve. Auditory perform. Reading Visual comp. Visual memory Auditory comp. Auditory memory	Current IQ H-P test score Fine motor Type involve. Extraocular movement	Motor involve. Potential intell. Gross motor Type involve. Auditory perform. Reading
Trend toward significant relationship	Poten. intell. Gross motor Type involve. Visual perform. Speech Writing Auditory comp.	Current IQ Bender Gestalt test perform.	Poten. intell. Aud. perform. Visual discrim. Visual memory	Auditory memory
No significant relationship	D-A-P test performance Aud. discrim.			

TABLE V

RELATIONSHIPS BETWEEN VARIABLES WHICH EMERGED AS SIGNIFICANT, NEAR SIGNIFICANT, OR NON SIGNIFICANT WHEN COMPARED WITH PASCAL-JENKINS SCALE VARIABLES

	P-J (Father + Mother)	P-J (Father only)	P-J (Mother only)
Significant relationship	Social functioning Fine motor Visual performance Writing Auditory comp. Auditory memory	Current IQ Speech Writing Auditory memory	Fine motor Visual performance Writing
Trend toward significant relationship	Current IQ Reading	Draw-A-Person Social functioning Reading Auditory comp.	Hunter-Pascal perform. Social functioning Potential intell. Reading Visual comprehension Visual memory Auditory comp.
No significant relationship	Motor involvement Bender-Gestalt test performance Gross motor Type involvement Extraocular move. Auditory perform. Visual discrim. Auditory discrim.		

variables and those variables which showed a trend toward significance. The raw data and means from which these tables were derived may be found from Table VII through Table XVIII of the Appendix.

Acceptable levels of significance were obtained for overall neurological data as compared with three variables, motor involvement, social functioning, and extraocular movement, while a trend toward significance included seven more variables, potential intelligence, gross motor behavior, type of involvement, behavior in response to visual stimuli, speech, writing, and auditory comprehension.

When the neurological data were further separated into sensory-motor, sensory, and motor variables, levels of significance were obtained with respect to twelve other variables which were not included when the overall neurological variable was taken alone. These additional variables were current intellectual functioning, Hunter-Pascal Concept Formation Test score, potential intelligence, gross motor behavior, fine motor behavior, type of involvement, behavior in response to auditory stimuli, reading, visual comprehension, visual memory, auditory comprehension and auditory memory. This left only Bender Motor Gestalt test performance, behavior in response to visual stimuli, speech, writing, and visual discrimination as variables showing trends toward

significance which did not show up as significant elsewhere. Two variables, Draw-A-Person test performance, and auditory discrimination, showed no relationship with any of the criterion variables derived from the neurological data.

Acceptable levels of significance were also achieved for father and mother combined on the P-J Scale as compared with social functioning, fine motor behavior, behavior in response to visual stimuli, writing, auditory comprehension and auditory memory. Trends toward significance were noted with respect to current intellectual functioning and reading.

When the P-J Scale data were further divided into father only and mother only variables, several variables which did not show any significant relationship with the criterion variable which combined father and mother now emerged as significant. These variables included current intellectual functioning and speech when the P-J Scale for father was used alone, and trends toward significance were achieved with Draw-A-Person test performance. When the P-J Scale for mother was used alone, there were no additional variables which showed a significant relationship other than those already considered. However, additional trends were noted for variables including the Hunter-Pascal test performance, potential intelligence, visual

comprehension and visual memory. Eight variables, motor involvement, Bender Motor Gestalt test performance, gross motor behavior, type of involvement, extraocular movement, behavior in response to auditory stimuli, visual discrimination, and auditory discrimination, showed no relationship with any of the criterion variables derived from the P-J Scale data.

In combining the neurological data and the P-J Scale data in order to derive an overall rating, one variable, current intellectual functioning, emerged as being significantly related while this relationship did not hold when either criterion variable was taken alone and compared with current functioning.

Neuromuscular Involvement and Parental Behavior

In an attempt to define parental behavior toward crippled children, several variables were compared in order to see if any relationships existed. Accordingly, the P-J Scale data with mother and father combined, mother only, and father only variables were compared with the neurological, motor involvement, and type of involvement variables.

The results are presented in Table VI. None of the variables attained significance although there was a trend toward a significant relationship between neurological

TABLE VI

COMPARISON OF NEUROMUSCULAR INVOLVEMENT WITH PARENTAL BEHAVIOR AND INTELLECTUAL FUNCTIONING

	Neuro-logical	Motor Involve-ment	Type of Involve-ment
P-J (Father + Mother)	6.4*	1.8	1.8
P-J (Father only)	5.9	4.5	1.1
P-J (Mother only)	6.7*	2.7	2.5
Current IQ	4.1	2.0	2.6
Hunter-Pascal test	5.3	1.8	10.6***
Bender-Gestalt	4.3	1.4	1.1
Draw-A-Person	3.5	5.2	2.7
Social Functioning	8.2**	6.2*	3.5
Potential IQ	6.2*	4.0	3.7
Reading	1.7	1.8	1.4
Writing	6.2*	3.9	1.8

*p between .05 and .10
**significant at the .05 level
***significant at the .025 level

involvement and the behavior of both parents and the behavior of mother alone.

Neuromuscular Involvement and Severity of Mental Defect

In order to demonstrate a relationship between the extent of neuromuscular involvement and the severity of mental defect, the neuromuscular involvement variables were compared with the various variables related to intellectual functioning.

The resulting chi square values are also presented in Table VI. Only two variables, Hunter-Pascal Test performance and social functioning, showed significant relationships with neuromuscular involvement. There was a direct relationship between Hunter-Pascal Test performance and type of involvement, and a direct relationship between the social functioning and neurological variables.

Three variables, social functioning, potential intelligence, and writing, showed a trend toward significance. Two of these variables, potential intelligence and writing, tended toward a direct relationship with the neurological variable while there was a tendency for social functioning to be directly related with motor involvement.

CHAPTER IV

DISCUSSION, SUMMARY AND CONCLUSIONS

Discussion

The findings in this study suggest a direct relationship between certain kinds of behavior in cerebral palsied children and brain damage or parental behavior. Pascal's formula, P.D. = f (brain damage + parental behavior), served adequately as a model. It was seen that almost all of the dependent variables, with the exception of only two variables, Draw-A-Person test performance and auditory discrimination, emerged as significant or near significant when compared with criterion variables derived from the neurological data.

In this respect the sensory-motor areas of the brain seemed to be more significantly related to various kinds of behavior than the other two sections of the brain which were predominantly involved in the cerebral palsied children of this sample. These other parts of the brain, the basal ganglia and the cerebellum, which were involved in the diagnoses of athetosis and ataxia, respectively, were considered as part of the neurological variable and tended to have an effect which reduced the number of significant variables.

These results tend to support the observation that severe spasticity in a child may be accompanied by a more devastating overall impairment which affects current functioning than either severe athetosis or ataxia among the cerebral palsied. The assumption which is generally made is that if the sensory-motor areas in the brain are damaged there is more likely to be diffusion to the areas which are necessary for the learning of skills than if damage in the basal ganglia or cerebellum had occurred. In other words, an athetoid or ataxic child with severe involvement does not have the extensive impairment in other areas of the brain that usually affects the spastic with severe involvement. For instance, according to Meyer (1950), spastic children are more apt to have difficulties in concept formation than the athetoids. Perlstein (1952) noted that in athetoids as a class the incidence of mental deficiency is lower than in spastics.

The two variables which showed no significant relationship with any of the neurological variables seemed to have atypical distributions of ratings. The Draw-A-Person test performance variable was heavily loaded with severe deficit ratings and the auditory discrimination variable contained mostly mild deficit ratings. These results were not suitable for analysis by the chi square technique.

The analysis of the relationship between the P-J

Scale variables and the other variables suggested that parental behavior is significantly related to the child's intellectual functioning. Only one variable related to intelligence, Bender Motor Gestalt test performance, was found to be non-significantly related to parental behavior. However, this again can be explained in terms of an atypical distribution of ratings. The ratings were predominantly severe so that analysis by the chi square technique was not suitable.

It was interesting to note that when the P-J Scale variable was split into "father only" and "mother only" variables, more variables were added to the list of significant relationships. At the same time it was somewhat surprising that the mother did not contribute more to the child's intellectual functioning.

The father emerged as an important figure in the child's functioning as noted by the significance of the current IQ variable and the near significance of the Draw-A-Person Test performance variable. The importance of the father in the early years of the child has been emphasized in previous studies by Pascal and Jenkins (1960, 1961) and Horner (1961). It was further noted that both parents play important roles in the child's ability to read and write. It also seemed as if the father contributed more to the child's auditory skills while the mother

contributed more to the child's visual skills.

Combining the neurological data and the P-J Scale data to be compared with the dependent variables did not seem to add significance to the results except in the areas of current intelligence and reading. Although each criterion variable was given equal weight in combining them for purposes of comparison with dependent variables, such an arbitrary procedure was deemed necessary because of the preliminary nature of the experiment. Future research may yield more adequate weights for each variable.

The question of parental behavior and its effect on the child's neuromuscular involvement was not settled in this study. However, there was a tendency toward an inverse relationship between parental behavior and neurological involvement. That is, the greater the deficit in neurological involvement the milder the deficit in parental behavior and conversely. Another way of stating this is that the more crippled the child the better the parent-child relationship and the less crippled the child the worse the parent-child relationship. Kammerer (1940) found similar results in his study in that the most severe cases tended to have the best family relationships.

The argument for a direct relationship between neuromuscular involvement and intellectual functioning was partly supported in two areas, namely, Hunter-Pascal Test

performance and social functioning. The results of the Hunter-Pascal Test performance are especially meaningful in that they seem to indicate, as suggested by Pascal and Jenkins (1959), that the test measures some aspect of cortical capacity not previously tapped by the usual intelligence tests.

Finally, it was not possible to analyze the emotional aspect of the cerebral palsied child's functioning in this study. Although this was one of the initial aims, the data available turned out to be inadequate. However, the few cues provided by some of the data, for example, motor involvement, compared with Bender Motor Gestalt test and Draw-A-Person Test performances, seemed to suggest no relationship between severity of neuromuscular involvement and degree of emotional maladjustment.

This was an exploratory study concerned with descriptive, testable data which require replication. It generated several hypotheses which now need to be tested further. These hypotheses are: (1) that Psychologic Deficit is a function of brain damage and parental behavior, (2) that there is a direct relationship between brain damage and behavior, (3) that there is a direct relationship between parental behavior and intellectual functioning, (4) that there is a direct relationship between neuromuscular involvement and severity of mental

defect, and (5) that there is an inverse relationship between neuromuscular involvement and parental behavior.

The implications of this study seem apparent with regard to treatment procedures in order to reduce Psychologic Deficit. If a relationship between cerebral palsied behavior and brain damage and parental behavior is demonstrated in replication studies, it would seem only natural to attempt to reduce the performance deficit due to organic and psychologic factors. Since brain damage is irreversible, emphasis may be laid on other physical disabilities which can be corrected. For instance, certain extraocular and orthopedic conditions can be corrected or improved by surgery, and various aids such as braces and weighted cuffs may also be applied to the involved limbs. Recently, certain drugs which serve as muscle relaxants have been introduced in order to alleviate spastic and athetoid conditions but their effectiveness is as yet unknown. Brain surgery has been performed in the past in the attempt to counteract the uninhibited, involuntary movements of the athetoid, but this practice has not been accepted as a solution to the problem. If the Psychologic Deficit is due in part to parental behavior, much can be done to alleviate the deficit through counseling of the parents as well as the cerebral palsied child in order to effect specific changes in behavior.

Summary and Conclusions

Psychologic Deficit in children with cerebral palsy was explored in terms of Pascal's formula, P.D. = f (brain damage + parental behavior).

The investigation of Psychologic Deficit included (1) gross motor behavior, (2) fine motor behavior, (3) type of involvement, (4) speech, (5) reading, (6) writing, (7) behavior in response to visual stimuli, (8) extraocular involvement, (9) behavior in response to auditory stimuli, (10) current intellectual functioning, (11) potential intelligence, (12) Hunter-Pascal Concept Formation Test performance, (13) Bender Motor Gestalt Test performance, (14) Draw-A-Person Test performance, (15) social development, and (16) degree of motor involvement. Expectancy levels were defined for each of these variables and rated in terms of mild, moderate, or severe deficit. These variables served as the dependent variables as compared with the criterion variables of brain damage and parental behavior.

Brain damage was assessed in terms of a thorough neurological examination which gave the extent and location of brain damage. The evaluations were also rated on a mild, moderate, severe deficit basis and compared with the ratings of the dependent variables. Parental behavior was appraised through the utilization of the Pascal-Jenkins

Behavioral Scales which require a systematic interview technique. The data were again rated on a mild, moderate, severe deficit basis and compared with the ratings of the dependent variables.

The subjects were fifteen cerebral palsied children between the ages of six and fifteen with different kinds and degrees of motor involvement. The results seemed to indicate a relationship between brain damage and almost all areas of sensory, motor and intellectual functioning which were considered. Further, deficit in parental behavior appeared to be related to almost all areas of intellectual functioning in the child which were considered.

Some other relationships were analyzed, namely neuromuscular involvement compared with parental behavior, and neuromuscular involvement compared with severity of mental defect.

This study gives support to the assumption that Psychologic Deficit is a function of brain damage and parental behavior. Several hypotheses were suggested, namely, that there is a direct relationship between brain damage and certain kinds of behavior, between parental behavior and intellectual functioning, and between neuromuscular involvement and severity of mental defect. There was also a suggestion that an inverse relationship exists between neuromuscular involvement and parental behavior.

The preliminary, exploratory nature of this study was emphasized, and a need for further investigation and replication was suggested. Implications of this study for treatment procedures were also noted.

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APPENDIX

TABLE VII

RATINGS BY TWO JUDGES OF SUBJECTS' MOTHERS ON SEVENTEEN VARIABLES

Subjects	Frequency of Contact		Play Activities		Displays of Affection		Providing Behavior		Restraints		Physical Punishment	
	A	B	A	B	A	B	A	B	A	B	A	B
1	3	3	3	3	3	3	3	3	3	2	3	3
2	3	3	3	3	3	3	3	3	3	3	3	3
3	2	2	2	2	3	2	3	3	3	2	2	2
4	2	2	2	2	3	3	2	2	2	2	2	2
5	3	2	3	3	3	3	3	3	2	2	3	3
6	3	3	1	1	2	2	3	3	2	2	3	3
7	2	2	3	3	3	3	2	2	2	2	2	2
8	3	3	2	2	3	3	3	3	3	3	3	3
9	3	3	2	2	2	2	3	3	2	3	3	3
10	2	2	3	3	3	3	3	3	3	3	3	3
11	3	3	2	2	2	3	3	3	2	2	3	2
12	3	3	3	3	3	3	3	3	2	3	3	3
13	2	2	1	1	2	2	2	2	3	3	2	2
14	3	3	3	2	3	3	2	2	3	3	2	2
15	3	3	2	3	3	3	3	3	3	3	3	3

TABLE VII (Continued)

Subjects	Verbal Punishment		Intellectual Behavior		Status		Social Behavior		Religious Behavior		Physical Health	
	A	B	A	B	A	B	A	B	A	B	A	B
1	2	3	2	3	3	3	3	3	3	2	3	3
2	3	3	3	3	2	2	2	3	2	3	3	3
3	2	2	2	2	2	2	3	3	3	3	3	3
4	2	3	1	1	2	2	2	3	1	2	2	2
5	3	3	1	2	2	2	2	2	3	3	1	1
6	3	3	3	2	2	2	2	2	3	2	3	2
7	3	3	3	3	3	3	2	2	3	3	3	3
8	2	3	2	3	3	3	3	3	3	3	3	3
9	1	2	2	2	1	2	3	3	1	1	2	1
10	2	2	3	3	3	3	3	3	3	3	3	3
11	2	3	3	3	3	3	3	3	1	2	2	2
12	3	3	3	2	3	3	3	3	3	3	2	3
13	3	2	1	2	2	2	2	2	2	2	3	2
14	3	3	3	3	1	2	2	2	3	3	3	3
15	3	3	3	3	2	3	2	3	3	3	1	2

TABLE VII (Continued)

Subjects	Compatible Behavior		Role Behavior		Variability of Habitat		Sexual Behavior		Deviant Behavior		Mean
	A	B	A	B	A	B	A	B	A	B	
1	2	2	3	3	3	3	3	3	3	3	2.8
2	2	3	3	3	2	1	3	3	3	2	2.7
3	3	3	2	2	3	3	3	3	3	3	2.5
4	2	2	2	2	2	1	3	2	2	2	2.0
5	2	3	3	3	3	3	ND	ND	3	3	2.5
6	2	2	3	3	3	3	ND	ND	3	2	2.4
7	2	3	2	2	3	3	2	3	2	2	2.5
8	3	3	3	3	3	3	ND	ND	3	3	2.9
9	3	2	3	3	3	3	3	3	2	2	2.3
10	3	3	3	3	2	2	3	3	3	3	2.8
11	2	2	2	2	2	2	2	2	2	2	2.4
12	3	3	3	3	2	3	2	2	2	2	2.8
13	1	1	2	2	2	2	3	3	1	1	2.0
14	2	2	3	3	3	3	2	2	3	3	2.6
15	2	3	3	3	3	3	3	3	3	3	2.8

TABLE VII

RATINGS BY TWO JUDGES OF SUBJECTS' FATHERS ON SEVENTEEN VARIABLES

Subjects	Frequency of Contact		Play Activities		Displays of Affection		Providing Behavior		Restraints		Physical Punishment	
	A	B	A	B	A	B	A	B	A	B	A	B
1	3	3	3	3	3	3	3	3	3	3	3	3
2	2	2	3	3	3	3	3	3	3	3	3	2
3	3	3	3	3	3	3	3	3	2	2	2	2
4	0	0	0	0	0	0	0	0	0	0	0	0
5	2	2	2	2	2	1	3	3	2	3	3	2
6	0	0	0	0	0	0	0	0	0	0	0	0
7	3	2	2	2	3	3	3	3	3	2	3	2
8	2	3	2	2	3	3	3	3	3	2	2	1
9	3	2	3	3	3	3	3	3	3	3	3	3
10	3	3	3	3	3	3	3	3	3	3	3	3
11	2	1	2	2	3	2	3	3	2	2	3	3
12	2	2	2	3	2	2	3	3	3	3	3	3
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0

TABLE VIII (Continued)

Subjects	Verbal Punishment		Intellectual Behavior		Status		Social Behavior		Religious Behavior		Physical Health	
	A	B	A	B	A	B	A	B	A	B	A	B
1	2	3	3	3	3	2	3	3	3	2	2	2
2	3	3	3	3	3	3	3	3	2	3	3	3
3	3	3	3	3	2	2	2	3	3	3	3	3
4	0	0	0	0	0	0	0	0	0	0	0	0
5	2	3	2	3	2	2	2	2	1	2	3	3
6	0	0	0	0	0	0	0	0	0	0	0	0
7	3	3	2	2	3	3	2	2	3	3	3	2
8	3	2	2	2	3	3	3	3	2	3	3	3
9	3	2	2	3	2	3	3	3	1	1	3	3
10	3	3	3	3	3	3	3	3	3	3	3	3
11	3	3	2	3	2	3	2	2	2	3	2	2
12	3	2	2	2	2	2	2	2	3	3	2	2
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0

TABLE VIII (Continued)

Subjects	Compatible Behavior		Role Behavior		Variability of Habitat		Sexual Behavior		Deviant Behavior		Mean
	A	B	A	B	A	B	A	B	A	B	
1	3	2	3	3	3	3	3	3	2	2	2.8
2	3	3	3	3	2	1	3	3	3	2	2.7
3	3	3	3	3	3	3	ND	ND	3	3	2.8
4	0	0	0	0	0	0	0	0	0	0	0
5	2	2	3	3	3	3	ND	ND	3	3	2.4
6	0	0	0	0	0	0	0	0	0	0	0
7	3	2	2	2	3	3	ND	ND	3	2	2.6
8	3	3	3	3	3	3	3	3	3	3	2.7
9	3	3	2	2	3	3	3	3	2	2	2.6
10	3	3	3	3	2	2	3	3	3	3	2.9
11	3	3	3	3	2	2	2	2	3	3	2.4
12	3	3	3	3	2	3	2	2	2	2	2.4
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0

TABLE IX

RATINGS, MEAN RATINGS, AND FINAL RATINGS FOR THE NEUROLOGICAL VARIABLE

S's	Sensory Areas	Motor Areas	Cere-bellum	Basal Ganglia	Mean	Rating
1	2	1	3	3	2.2	Sev.
2	1	1	3	3	2.0	Sev.
3	2	2	2	3	2.2	Sev.
4	3	2	3	3	2.8	Mild
5	2	2	1	3	2.0	Sev.
6	2	2	3	3	2.5	Mod.
7	2	3	3	1	2.2	Sev.
8	2	2	3	3	2.5	Mod.
9	3	2	3	3	2.8	Mild
10	3	2	3	3	2.8	Mild
11	2	2	2	2	2.0	Sev.
12	2	2	3	3	2.5	Mod.
13	3	2	3	3	2.8	Mild
14	3	1	3	3	2.5	Mod.
15	3	2	3	3	2.8	Mild

TABLE X

MEAN RATINGS FOR MOTHER, FATHER, AND BOTH PARENTS COMBINED ON THE PASCAL-JENKINS SCALE

S's	Mother		Father		Both	
1	2.8	Mild	2.8	Mild	2.8	Mild
2	2.7	Mod.	2.7	Mod.	2.7	Mod.
3	2.5	Mod.	2.8	Mild	2.6	Mod.
4	2.0	Sev.	0	Sev.	2.0	Sev.
5	2.5	Mod.	2.4	Mod.	2.4	Mod.
6	2.4	Mod.	0	Sev.	2.4	Mod.
7	2.5	Mod.	2.6	Mod.	2.6	Mod.
8	2.9	Mild	2.7	Mod.	2.8	Mild
9	2.3	Mod.	2.6	Mod.	2.4	Mod.
10	2.8	Mild	2.9	Mild	2.8	Mild
11	2.4	Mod.	2.4	Mod.	2.4	Mod.
12	2.8	Mild	2.4	Mod.	2.6	Mod.
13	2.0	Sev.	0	Sev.	2.0	Sev.
14	2.6	Mod.	0	Sev.	2.6	Mod.
15	2.8	Mild	0	Sev.	2.8	Mild

TABLE XI

RAW SCORE DATA AND RATINGS ON VARIABLES
DEALING WITH INTELLECTUAL FUNCTIONING

S's	Current IQ	Rating	Hunter-Pascal Score	Rating	D-A-P Rating	B-G Rating	Social SQ	Rating	Potential IQ	Rating	Reading Rating	Writing Rating
1	82	Mod.	260	Sev.	Sev.	Sev.	87	Mod.	90	Mild	Mod.	Mod.
2	66	Sev.	251	Mod.	Sev.	Sev.	30	Sev.	120	Mild	Sev.	Sev.
3	58	Sev.	266	Sev.	Sev.	Sev.	67	Sev.	60	Sev.	Sev.	Sev.
4	89	Mod.	206	Mild	Sev.	Mod.	85	Mod.	100	Mild	Sev.	Mild
5	50	Sev.	266	Sev.	Sev.	Sev.	60	Sev.	62	Sev.	Sev.	Sev.
6	76	Mod.	250	Mod.	Mod.	Sev.	99	Mild	82	Mod.	Mod.	Mod.
7	86	Mod.	177	Mild	Sev.	Sev.	67	Sev.	100	Mild	Mild	Sev.
8	38	Sev.	250	Sev.	Sev.	Sev.	50	Sev.	60	Sev.	Sev.	Sev.
9	56	Sev.	254	Sev.	Sev.	Sev.	85	Mod.	70	Mod.	Sev.	Sev.
10	81	Mod.	242	Mild	Mild	Sev.	89	Mod.	90	Mild	Mod.	Mod.
11	33	Sev.	271	Sev.	Sev.	Sev.	40	Sev.	50	Sev.	Sev.	Sev.
12	51	Sev.	251	Mild	Sev.	Sev.	72	Mod.	75	Mod.	Sev.	Sev.
13	72	Mod.	242	Mild	Mild	Sev.	78	Mod.	82	Mod.	Mild	Mild
14	71	Mod.	261	Sev.	Sev.	Sev.	40	Sev.	82	Mod.	Sev.	Sev.
15	125	Mild	177	Mild	Mod.	Mod.	130	Mild	125	Mild	Mod.	Mod.

TABLE XII

RATINGS, MEAN RATINGS, AND FINAL RATINGS FOR GROSS MOTOR BEHAVIOR

S's	Sit	Stand	Walk	Mean	Rating
1	2	1	1	1.3	Sev.
2	1	1	1	1.0	Sev.
3	2	2	2	2.0	Mod.
4	3	2	2	2.3	Mod.
5	2	1	1	1.3	Sev.
6	3	2	2	2.3	Mod.
7	2	1	1	1.3	Sev.
8	3	2	2	2.3	Mod.
9	3	3	2	2.7	Mild
10	3	2	2	2.3	Mod.
11	2	2	2	2.0	Mod.
12	3	3	2	2.7	Mild
13	3	3	2	2.7	Mild
14	2	1	1	1.3	Sev.
15	3	2	2	2.3	Mod.

TABLE XIII

RATINGS, MEAN RATINGS, AND FINAL RATINGS FOR FINE MOTOR BEHAVIOR

S's	Finger-finger	Thumb Apposition	Tremor	Mean	Rating
1	2	2	2	2.0	Mod.
2	1	1	2	1.3	Sev.
3	2	2	2	2.0	Mod.
4	3	3	3	3.0	Mild
5	2	2	2	2.0	Mod.
6	2	2	3	2.3	Mod.
7	2	2	3	2.3	Mod.
8	2	2	3	2.3	Mod.
9	2	2	2	2.0	Mod.
10	2	2	3	2.3	Mod.
11	1	2	2	1.7	Sev.
12	2	2	3	2.3	Mod.
13	2	2	3	2.3	Mod.
14	2	3	2	2.3	Mod.
15	2	2	2	2.0	Mod.

TABLE XIV

RATINGS, MEAN RATINGS, AND FINAL RATINGS FOR TYPE OF INVOLVEMENT

S's	Athe-tosis	Spastic	Ataxic	Mean	Rating
1	3	1	3	2.3	Mod.
2	1	1	3	1.7	Sev.
3	3	3	2	2.7	Mild
4	3	2	3	2.7	Mild
5	3	3	1	2.3	Mod.
6	3	2	3	2.7	Mild
7	1	3	3	2.3	Mod.
8	2	3	3	2.7	Mild
9	3	3	2	2.7	Mild
10	3	2	3	2.7	Mild
11	2	3	3	2.7	Mild
12	3	2	3	2.7	Mild
13	3	2	3	2.7	Mild
14	3	1	3	2.3	Mod.
15	2	3	3	2.7	Mild

TABLE XV

RATINGS, MEAN RATINGS, AND FINAL RATINGS FOR BEHAVIOR IN RESPONSE TO VISUAL STIMULI

S's	Acuity	Form Discrimination	Color Discrimination	Comprehension	Memory	Mean	Rating
1	2	2	3	2	2	2.2	Mod.
2	3	3	3	3	2	2.8	Mild
3	1	1	3	1	1	1.4	Sev.
4	3	3	3	2	3	2.8	Mild
5	2	1	2	1	1	1.4	Sev.
6	2	3	3	1	2	2.2	Mod.
7	3	3	3	3	3	3.0	Mild
8	3	3	2	1	1	2.0	Mod.
9	2	3	2	1	1	1.8	Sev.
10	2	3	3	3	3	2.8	Mild
11	2	2	3	1	1	1.8	Sev.
12	3	3	3	3	3	3.0	Mild
13	3	3	3	3	3	3.0	Mild
14	2	3	3	1	1	2.0	Mod.
15	2	2	2	3	3	2.4	Mod.

TABLE XVI

RATINGS, MEAN RATINGS, AND FINAL RATINGS FOR EXTRAOCULAR MOVEMENT

S's	Eye Movement	Strabismus	Nystagmus	Mean	Rating
1	2	2	3	2.3	Mod.
2	1	3	1	1.7	Sev.
3	2	2	2	2.0	Mod.
4	3	3	3	3.0	Mild
5	2	2	3	2.3	Mod.
6	3	3	3	3.0	Mild
7	2	2	3	2.3	Mod.
8	2	3	3	2.7	Mild
9	3	3	3	3.0	Mild
10	3	3	3	3.0	Mild
11	2	2	3	2.3	Mod.
12	3	3	3	3.0	Mild
13	2	3	2	2.3	Mod.
14	2	3	3	2.7	Mild
15	3	3	3	3.0	Mild

TABLE XVII

RATINGS, MEAN RATINGS, AND FINAL RATINGS FOR BEHAVIOR IN RESPONSE TO AUDITORY STIMULI

S's	Acuity	Discrimination	Comprehension	Memory	Mean	Rating
1	3	3	2	3	2.8	Mild
2	3	3	3	3	3.0	Mild
3	3	3	1	1	2.0	Mod.
4	3	3	2	2	2.5	Mod.
5	3	2	1	1	1.8	Sev.
6	3	3	1	3	2.5	Mod.
7	2	2	3	3	2.5	Mod.
8	2	2	1	1	1.5	Sev.
9	3	3	1	1	2.0	Mod.
10	3	3	2	2	2.5	Mod.
11	3	3	1	1	2.0	Mod.
12	1	1	1	1	1.0	Sev.
13	2	2	2	2	2.0	Mod.
14	3	3	1	2	2.2	Mod.
15	3	3	3	3	3.0	Mild

TABLE XVIII

RATINGS, MEAN RATINGS, AND FINAL RATINGS FOR SPEECH

S's	Dysar-thria	Articu-lation	Rhythm	PIQV	Mean	Rating
1	3	3	3	3	3.0	Mild
2	1	1	1	1	1.0	Sev.
3	3	2	3	3	2.6	Mod.
4	3	3	3	3	3.0	Mild
5	2	2	3	3	2.4	Mod.
6	3	3	3	3	3.0	Mild
7	3	2	2	3	2.6	Mod.
8	2	1	2	1	1.6	Sev.
9	2	2	3	2	2.4	Mod.
10	3	3	3	3	3.0	Mild
11	1	1	1	1	1.0	Sev.
12	1	1	1	1	1.0	Sev.
13	3	2	3	2	2.6	Mod.
14	3	3	3	3	3.0	Mild
15	3	2	3	3	2.8	Mild